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Energy Key Performance Indicators

A European Benchmark and Assessment of Meaningful Indicators for the Use of Energy in Large Corporations

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Abstract

This study aims to identify and analyze energy key performance indicators among large European companies. Energy usage has become a very meaningful topic for both internal management as well as external stakeholders of a company. A review of current literature suggests that while environmental indicators in general have found broad attention and plenty of theories concerning good and meaningful indicators are published, no study investigating actually applied energy indicators exists. Therefore, this study gives an overview of predominant indicators on energy consumption and efficiency in three different energy-intensive industries. Through the application of content analysis to energy indicators published online, in separate reports or in the company's annual report, the content and quality of indicators was assessed and compared. The findings of this cross-sectional study suggest, that reporting on energy key performance indicators in general takes place at a high quality level, with disclosures being qualitative as well as quantitative and oftentimes comparable over time. Frequently applied indicators are those suggested by the GRI framework as well as very general energy indicators. Several less wide spread and industry-specific indicators are found to have a large potential as meaningful and informative energy key performance indicators. Concerning the nature as well as the quality of energy indicators, differences exist across industries as well as across countries. Overall, this study is able to provide guidance concerning the choice and composition of energy key performance indicators and adds to the existing knowledge base on environmental indicators.

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Abbreviations

CERES	Coalition for Environmentally Responsible Economies
CR	Corporate Responsibility
CSR	Corporate Social Responsibility
DJSI	Dow Jones Sustainability Index
EMAS	Eco-Management and Audit Scheme
EU	European Union
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
IASB	International Accounting Standards Board
ISO	International Organization for Standardization
KPI	Key Performance Indicator
PRTR	Pollutant Release and Transfer Registers
SRI	Socially Responsible Investing
UNEP	United Nations Environmental Programme
UNGC	United Nations Global Compact

1 Introduction

Energy security, climate change and rising energy prices are repeatedly at top of the political agenda. Large energy savings opportunities exist and are expected to be realized (Pasquier and Saussay, 2012). The European Union (EU) has decided to respond with ambitious targets to cut greenhouse gas (GHG) emissions and reform the energy sector that are part of its Europe 2020 strategy and better known as EU 20/20/20 targets. The strategy entails a planned reduction in GHG emissions by 20% relative to the base year of 1990 by 2020, a reduction in energy consumption by 20% and an increase in the share of renewable energy by 20%. In this process, the private sector plays a decisive role. As large consumers of energy, companies have a considerable impact. But it is not just for the sake of political pressure that business attempts to reduce energy consumption and to increase efficiency, as proposed by Bunse et al. (2011). Current developments are rather of strategic importance for organizations. Rising energy prices influence the profit margins, external stakeholders are becoming more aware of companies' environmental footprints and energy scarcity can alter whole business models.

In order to identify energy savings opportunities and to assess a company's dependence on energy, the collection of energy related indicators can play an important role. Arguably easy to collect and measure, energy key performance indicators (KPIs) hold useful information about a company's energy performance (Cowan et al., 2010). The information inherent in these indicators is not only meaningful for internal management, but also of interest for external users. Jasch (2000) describes energy indicators as being crucial to the development of environmental and energy-related targets as well as for comprehensive environmental reporting. While energy targets are related to internal management processes, environmental reporting targets external stakeholders. With the Socially Responsible Investing (SRI) industry experiencing an upsurge, energy KPIs are of special interest for the stakeholder group of (environmentally responsible) investors. The inclusion of non-financial information in a company analysis could lead to superior returns and influence the investment choice made. Some even argue that environmental research should be a focus area for investment analysis, instead of being merely a screening method (Dillenburg et al., 2003).

Given the information potential that energy KPIs can possess, questions concerning their definition, nature and detail of disclosure might arise for companies as well as for other stakeholders. Since the selection and choice of energy indicators is yet a voluntary and largely secluded process, differences in definition and fit of KPIs can be expected.

1.1 Research Question and Background

Following the reasoning above and a review of existing literature this research question has been developed:

Which energy key performance indicators do large European organizations predominantly use and are these both meaningful for stakeholders and useful for the company at the same time?

The guiding research question is subsequently broken down into four supporting questions that will be used in this study.

1) Who reports on energy usage and efficiency?

It has been argued by Enderle and Tavis (1998) that, since companies are embedded in the ecological system, they carry a certain responsibility to budget natural resources sensibly. Rising energy prices raise the attentiveness of investors towards the energy use of companies and increase the value of a disclosures referring to this. According to recent literature, reporting on non-financial data has experienced significant growth. KPMG (2011) shows that among the 250 largest companies worldwide reporting on corporate responsibility (CR) has increased steadily over the past 12 years. Certain industries can thereby be considered as frontrunners while others are catching up. While studies by authors such as Hooks and van Staden (2011) have performed benchmark studies of environmental disclosures comparing the external ranking versus the quality of the reported content, no existing studies focus on looking at energy related data specifically.

2) *What information on energy is reported by large European organizations?*

In order to give helpful guidance, not only the existence, but also the content of energy related disclosures is important. With this, the study refers to the definition of the published indicators. Even though guidelines exist, they are not necessarily convergent, as stated by Bartelmus (2003). Through the joint stakeholder initiative developing a globally excepted reporting standard with the Global Reporting Initiative (GRI), some progress has been made towards better comparability and clearer guidance for companies, but not all issues have been resolved. Brink and Woerd (2004) suggest the GRI guidelines to lack preciseness and to be overly complicated, not necessarily giving justice to what needs to be measured in the specific kind of business a company is in.

3) Are there divergences between industries and countries concerning the reported KPIs?

Following from Brink and Woerd's (2004) line of reasoning is the question whether energy related indicators could and should be the same for all industries. Betianu (2010) argues that indicators need to be individualized with respect to the industry in order to ensure a meaningful basis for business analysis. Kolk (2004) finds notable differences in reporting patterns between sectors and with the introduction of sectoral versions of the GRI guidelines, its relevance for the companies was expected to increase as suggested by Willis (2003). The GRI's Sector Supplements are meant to include unique sustainability issues for certain industries and introduce some additional sector-specific indicators (GRI, 2013). But not all companies use the GRI framework and out of those using this particular guideline not all report according to their Sector Supplement (KPMG, 2011).

4) To what extent is the reported information meaningful to investors and management?

While non-financial reporting has gained increasing popularity (KPMG, 2011), the indicators disclosed are not necessarily meaningful and empowering for information users (Dingwerth and Eichinger, 2010). According to Fung et al. (2007) meaningful indicators need to be valuable, accessible, comprehensible and comparable. Other frameworks exist suggesting attributes key performance indicators need to possess in order to be useful, both for internal users and for external users. What most authors agree upon is the notion that in order to be meaningful disclosed indicators need to be embedded in the decision making process of strategic management and investors (Dillenburg et al., 2003; Fung et al. 2007; Keeble et al., 2003; Matthews, 2011).

1.2 Purpose

The disclosure of non-financial indicators has substantially increased over the past twenty years along with an interest in corporate social responsibility. Several authors have published literature concerning sustainability reporting in general as well as environmental reporting in particular, in order to both, follow the development, and critically assess the potential these disclosures carry for the companies that publish them as well as for interested stakeholders. While descriptive publications assessing the completeness of indicators are widely available, focused studies, shedding light on occurrence and nature of energy indicators are limited.

The use of energy in organizations carries both environmental as well as financial value. It can hence be an important indicator for company performance. The largely voluntary nature of non-financial reporting however may lead to confusion among companies about what to

choose and disclose as a good performance indicator and subsequently lead to a low level of comparability for external users.

This study therefore aims to provide a systematic analysis of the types of energy indicators used in practice. Its purpose is to give insights on energy indicators chosen by large European companies and to tentatively assess their comprehension and value added. The study focuses on companies in three energy-intensive industries in Europe and provides a cross-sectional overview on energy reporting. Ideally, a mix of several comprehensive and mutually supportive energy KPIs can be identified.

1.3 Structure

The remainder of this study has been organized into five sections. It starts of with a review of relevant literature in order to understand the current state of research in the field and to identify gaps. It then continues with a methodology section outlining the research design, gathering of data and the analytical framework. This section is followed by the findings and their discussion. The study is concluded with some final remarks suggesting implications of the study as well as areas for further research.

2 Literature Review

This chapter gives a review of relevant literature in the field of energy related KPIs. It examines existing literature dealing with purpose and use of KPIs in general and the findings with respect to energy in particular. It further investigates existing data collecting and reporting systems and shows how this study can contribute to the field.

Existing literature shows that energy related KPIs can be meaningful and helpful for internal as well as for external users of company data. In particular, energy related data collection and reporting is suggested to lead to a 'win-win' situation for organizations, not only serving environmental but also economical motives. The field of external users of energy KPIs is consistently increasing with the growing interest in corporate social responsibility. The most technical use hereof lies with a particular set of so-called ethical investors who include non-financial data into their stock-analysis.

Remaining confusion results from the voluntary aspect of non-financial reporting. The literature review shows that even though certain guidelines and frameworks for reporting exist, there is a problem of comparability. The data reported varies among and within sectors. While one voluntary reporting standard has gained popularity and seems to become a dominant guideline, little attention has been paid in the literature to the resulting energy KPIs used by organizations and their actual comparability.

This literature review is structured developing the topic of energy KPIs by encompassing its origin as well as deployment. It starts with a more general description of KPIs and then narrows down to energy data and its use. Building up on the purpose of such indicators a discussion of guidelines follows and the current state of non-financial reporting. Further, the difference between voluntary and mandatory reporting is highlighted. The literature review is concluded with an overview over studies analyzing the content of environmental reports.

2.1 Key Performance Indicators

This part of the literature review introduces KPIs in the context of organizations and sheds light on the perceived purpose of such indicators. It further initiates a first understanding of what defines good and meaningful indicators.

2.1.1 Purpose of Performance Indicators

Performance measurement and the establishment of measurement systems have received a high degree of attention in the literature. Neely et al. (1996) however argue, that performance measurement has been frequently discussed, but to a far lesser degree defined. A performance measure, also referred to as performance indicator, has been described in organizational and strategic literature as quantifying the efficiency and outcome of a purposeful action (Matthews, 2011; Neely et al. 1996; Waggoner et al., 1999). This understanding implies, that performance is the efficiency and effectiveness of an action, where efficiency is related to the company's economic use of its resources and effectiveness to the degree to which customers' needs are met (Neely et al., 1996). Dillenburg et al. (2003) put the organizational relevance of performance indicators more simply: "what gets measured gets managed" (170).

The impact of performance indicators on corporate behavior is arguably quite strong (Dillenburg et al., 2003; Waggoner et al., 1999). Johnston et al. (2002) and Globerson (1985) state that performance indicators in organizations are perceived as tools supporting the strategic goals of an organization. A smaller set of chosen performance indicators is called key performance indicators. Matthews (2011) gives the following definition:

"Key performance indicators (KPIs) help an organization define and evaluate how successful it is, typically in terms of making progress toward its long-term organizational goals (88)."

He suggests KPIs to be surrogates for organizational effectiveness and highlights the importance of a careful process of KPI definition, measurement and determination for strategic purposes (Matthews, 2011). In line with Matthews' understanding are Goold and Quinn (1990), who consider KPIs to be an integral part of strategic controlling, making it possible to assess whether management has achieved their objectives. Neely et al. (1996) understand the purpose of performance indicators in their potential to influence behavior and induce action.

In their review on forces shaping performance measurement systems Waggoner et al. (1999) identify several reasons for introducing performance indicators. They mention performance monitoring, the identification of areas in need for improvement, increasing motivation, improving communication and strengthening accountability (Waggoner et al., 1999). Johnston et al. (2002) on the other hand come up with a series of reasons to limit the number of performance indicators. They suggest that the proliferation of literature and conferences on

performance measurements has led to an overkill, hindering managers to actually take action since they are occupied measuring (Johnston et al. 2002). Real value is hence added when performance measurement is used as a facilitator, with the indicators being linked to the company's goal and vision (Johnston et al., 2002; Matthews, 2011).

2.1.2 What Qualifies as Good Indicators

In the literature characteristics good indicators need to possess are divers and alter depending on the user group the indicators are developed for. What most authors however agree upon is that they should be related to the organization's objectives (Fung et al., 2007; Globerson, 1985; Keeble et al., 2003; Matthews, 2011). Globerson (1985) states that any indicator that holds information on the organizational development is relevant, given that the purpose it serves is clear. Similarly, Fung et al. (2007) argue that the transparency provided is only effective when the information gained from the indicators is actually embedded in strategic management objectives internally as well as in the decision-making process of external information users. They state that any indicator needs to fulfill the criterion of improving the choices of the information users.

Since organizations operate in a changing environment, indicators used to assess the development of a company cannot be of a static nature, as indicated by Waggoner et al. (1999) and Matthews (2011). They are found to be solely useful if regularly adjusted to the current competitive environment an organization is in (Waggoner et al., 1999). Matthews (2011) in this context states the important characteristics of flexibility, timeliness and alignment. Alignment is however not only understood as alignment with objectives and the current environment, but also with regard to other indicators, according to Goold and Quinn (1990). They argue that an indicator needs to work in the context of other indicators, that good indicators supplement each other and are prioritized. On the same note, Keeble et al. (2003) state that a chosen set of indicators needs to be balanced in order to be good. Further, objective indicators are preferred over subjective indicators, which shall enable a basis for comparison with other companies (Globerson, 1985). Table 1 is used to categorize some characteristics that, according to different authors, good and meaningful performance indicators need to possess.

Table 1: Selected characteristics of performance indicators

Author(s)	*Characteristic*	*User Group addressed*
Globerson (1985)	Indicators should be *aligned* with corporate goals.	Internal
Keeble et al. (2003)	Indicators should be *embedded* in strategic management.	External and Internal
Fung et al. (2007)		External and Internal
Matthews (2011)		Internal
Waggoner et al. (1999)	Indicators should be *adjusted/flexible*.	Internal
Matthews (2011)		Internal
Fung et al. (2007)	Indicators should be *timely*.	External and Internal
Matthews (2011)		Internal
Maskell (1991)	Indicators should be *purposeful/relevant*.	Internal
Kolk (2004)		External
Fortuin (1988)	Indicators should be *clearly defined/simple.*	Internal
Goold and Quinn (1990)		Internal
Hronec (1993)		Internal
Keeble et al. (2003)		External and Internal
Kolk (2004)	Indicators should be *normative* as best as possible.	External
Goold and Quinn (1990)	Indicators should be *measurable/quantitative*.	Internal
Kolk (2004)		External
Globerson (1985)	Indicators should be *comparable/relative to competitors' achievements*.	Internal
Goold and Quinn (1990)		Internal
Keeble et al. (2003)		External and Internal
Kolk (2004)		External
Fortuin (1988)	Indicators should be *cost-effective.*	Internal
Hayes et al. (1988)		Internal
Bungay and Goold (1991)	Indicators should *form part of the control-loop*.	Internal
Kolk (2004)	Indicators should be *detailed/accurate.*	External
Matthews (2011)		Internal

Source: Own illustration according to Neely et al. (1996)

In the existing literature characteristics defining good indicators differ according to the user group addressed. As illustrated by table 1, authors have had different user groups in mind when suggesting important characteristics. Most of them have either internal users or external users in mind, while only two publications in this sample consider both user groups. It can however be seen that many of the characteristics suggested can serve both user groups at the same time.

Goold and Quinn (1990) choose characteristics, which are supposed to motivate the internal user group of managers. They argue that the collection and observation of indicators shall be simple and to some extent rewarding for management. Be it through the possibility to compare an organization's performance over time or relative to its competitors' achievements. Kolk (2004) also stresses the characteristic of comparability, but he focuses more on the informative purpose of indicators for external stakeholders. Fung et al. (2007) and Keeble et al. (2003) on the other hand consider both, internal and external users, when defining

timeliness and being embedded in decision-making as characteristics for good indicators. They see the value of information provided by good indicators for internal as well as for external decision-making. Keeble et al. (2003) therefore argue that stakeholder dialogue can play an important role in choosing the 'perfect' set of indicators.

2.2 Importance of Energy and Energy Efficiency Data

In the following section of the literature review the importance of energy related data for two different sets of users is treated. The section covers findings about the role of environmental disclosures for management purposes on the one hand and for external stakeholders on the other hand. Due to the literature review revealing an increased interest in environmental disclosures by investors and since it is suggested that this particular external stakeholder group makes the most direct use of the data provided, the study focuses on investors as external data users.

2.2.1 Internal Use for Management Purposes

Reviewing findings on the importance of energy data for management purposes, researchers often highlight the strong link between natural resources and company growth (Allcott and Greenstone, 2012; Cetindamar and Husoy, 2007; Enderle and Tavis, 1998; Nordhaus et al., 1973). According to Enderle and Tavis (1998) organizations are not only surrounded, but practically embedded in the ecological system. Their consumption of natural resources leads to a dependence on their availability on the one hand and to a responsibility towards the ecological system on the other hand. Nordhaus et al. (1973) find that an organization's growth is bound and limited by the availability of finite natural resources. They perceive energy as an essential input into any organization's production with its consumption necessarily leading to an environmental impact.

Several authors have further identified the financial value of energy savings (Allcott and Greenstone, 2012; Bloom et al., 2010; Cetindamar and Husoy, 2007; Cowan et al., 2010; Enderle and Tavis, 1998; Porter and Linde, 1995). In their paper, Enderle and Tavis (1998) suggest a balanced concept for organizations, combining economical, social and environmental responsibilities. Savings in energy consumptions in particular are found to make both economic and environmental sense. They further argue that environmental and economic responsibilities partly overlap when it comes to the use of energy, since energy savings can be justified both from a purely economic as well as from a noneconomic point of view. While Enderle and Tavis (1998) remain cautious and speak of the overlap being only partial, other authors such as Porter and Linde (1995) and Cetindamar and Husoy (2007)

argue more strongly and suggest a ‘win-win’ situation. Porter and Linde (1995) suggest that well placed environmental standards and goals in organizations will trigger innovations that will subsequently lower overall costs. Similarly, Cetindamar and Husoy (2007) note that environmentally sound measures are often at the same time economically sound and have the potential to result in higher profits in the long run. This theoretical assumption has been tested and confirmed by Al-Tuwaijri et al. (2004) who found a significant positive relation between environmental and economic performance.

Al-Tuwaijri et al. (2004) further suggest that environmental performance and economic performance are closely linked to management quality. Indeed, management seems to have realized the importance of tackling energy usage and energy efficiency. Bloom et al. (2010) were able to find a positive relationship between good management practices and productivity/energy efficiency, suggesting that well-run firms use energy more efficiently. Similarly, Montabon et al. (2007) argue that environmental management practices are positively related to firm performance. In order to reach environmental and other organizational goals Waggoner et al. (1999) and Caldelli and Parmigiani (2004) perceive exclusively financial performance measures as not sufficient. They support the inclusion of non-financial indicators in organizational performance measurement systems. Authors have found support for the notion that environmental accounting can positively influence an organization’s ability to estimate and control environmental costs (Buhr, 1998; Caldelli and Parmigiani, 2004; Li and McConomy, 1999). Dingwerth and Eichinger (2010) argue that collecting data will raise awareness and could set internal processes within the organization in motion. Caldelli and Parmigiani (2004) likewise suggest that the inclusion of environmental goals in a performance measurement system will help to manage these as well as to report on transition. They state that environmental accounting is used to improve the organizational oversight over impact and effects the organization’s action have on the environment and with respect to energy. Cowan et al. (2010) further note, that especially energy consumption and conservation qualifies for setting measurable targets.

While saving costs and fostering innovation are considered important motivations to engage in environmental accounting and the use of energy related indicators, other motivations have been identified in the literature. Lee and Hutchison (2005) for example value risk management to be equally important as saving costs. They find an organization’s wish to control environmental risks a major motivation to perform environmental accounting and collect environmental data. Next to environmental risks, expected political costs, due to

changes in legislation also drive environmental accounting (Lee and Hutchison 2005). Bunse et al. (2011) similarly stress the importance of integrating energy efficiency measures into management operations due to new environmental regulations coming up. Additionally, they introduce two other drivers: rising energy prices and a changing purchasing behavior of customers. They state that since in energy- intensive industries energy contributes about 60% of the costs involved, reducing the company's energy consumption can have a considerable effect on the financial bottom line. Further, customers exercise pressure and are increasingly looking for "greener" products (Bunse et al., 2011).

SustainAbility/UNEP (1998) as well as KPMG (2011) conducted surveys identifying organizational motivations to not only collect but also report non-financial data. While the study published by SustainAbility and UNEP focuses on environmental reporting, the KPMG survey treats non-financial reporting in general. Responses to the SustainAbility/UNEP study on motivations for environmental reporting included among others: a perceived enhanced ability to track the organizational process against specific targets, the possibility to facilitate the implementation of the environmental strategy, a resulting greater awareness of broad environmental issues throughout the organization, the identification of cost savings, increasing efficiency as well as enhanced business development opportunities and staff morale (SustainAbility/UNEP, 1998). The findings of KPMG (2011) among the 250 largest companies worldwide support the motivations suggested by several of the authors above. While reputational considerations rank first, followed by ethical considerations and employee motivation, innovation and learning, in line with Porter and Linde (1995), also seem to set incentives. Similarly, risk reduction and the relationship with governmental authorities are stated as motivations to report on non-financial data, supporting Lee and Hutchison's (2005) argumentation (KPMG, 2011).

Other authors such as Brink and Woerd (2004) note that a benchmark with peers on the basis of non-financial indicators can serve management purposes and constitutes a further reason for organizations to collect and report data. This is substituted by growing public pressure and interest, according to Caldelli and Parmigiani (2004). Conversely, reasons not to report environmental data have also been investigated. An interesting reason identified by SustainAbility/UNEP (1998) was the difficulty to select correct indicators. Few publications focus on the collection and disclosure of energy data in particular, but Keeble et al. (2003) as well as Brink and Woerd (2004) suggest that energy as an in-house indicator is not very hard to collect, while it can offer useful information.

2.2.2 External Use for Stakeholders and SRI

Environmental disclosures are increasingly of interest for a variety of non-management stakeholders, including employees, investors, creditors, regulators, non-governmental organizations and unions (Lee and Hutchison, 2011; Dingwerth and Eichinger, 2010). Dingwerth and Eichinger (2010) argue that non-financial information about an organization is a means of empowerment for stakeholders. KPIs may enable stakeholders to make informed decisions about a company, confront them in case something is causing trouble, and potentially hold the company accountable (Dingwerth and Eichinger, 2010; Dubbink et al., 2008). Dubbink et al. (2008) speak of increased consumer freedom in this context. But both Dingwerth and Eichinger (2010) and Willis (2003) consider being responsive to stakeholder information needs challenging, due to the diverse expectations different stakeholders have. Contrary to financial reporting no "primary set of users" exists (Willis, 2003).

Several authors have stated that environmental information can be of especially high importance for investors (Aerts et al., 2008; Dingwerth and Eichinger, 2010; Hope, 2003). Not only are pension funds in some European countries required to state in how far they consider environmental information in their investment decisions, but also is this kind of information frequently processed in investment decisions (Emtairah, 2002). It is thereby used for the development of earnings forecasts (Aerts et al., 2008). According to Dillenburg et al. (2003) there has been support for the notion that environmental research should be a core area of focus for an investment analysis instead of being understood as part of the social screen. Emtairah (2002) highlights one distinct use of data related to energy by investors, stating that performance indicators concerning energy efficiency and energy consumption by source can give an indication of the organization's relation to an unstable market for non-renewable energy. Dingwerth and Eichinger (2010) suggest that for investors non-financial reporting has an obvious value, since it reduces their searching efforts for environmental information and enhances the comparability of the data. Interestingly in this context, Aerts et al. (2008) find a positive relationship between environmental disclosure and the accuracy of financial forecasts.

McLachlan and Gardner (2004) and others make a distinction here between conventional investors and socially responsible investors claiming that especially socially responsible investors consider environmental and other non-financial information in their stock assessment, thereby combining social values with financial objectives (Dillenburg et al. 2003; Hill et al., 2007; McLachlan and Gardner, 2004). Willis (2003) states that the additional

information is believed to help investors identify a portfolio, which will outperform those portfolios created on the basis of purely financial data and consequently achieve superior returns. Applied manifestations of this belief include stock indexes such as the FTSE4Good or the Dow Jones Sustainability Index (DJSI). Several studies investigating this relationship have shown contradictory results, mostly proofing no significant outperformance (Capelle-Blancard and Monjon, 2011; Gregory and Whittaker, 2007; Jones et al. 2008; Kadiyala, 2009). A further intention of socially responsible investment can however not be empirically refuted. Hill et al. (2007) state that beyond the financial motivation investments are made in order to initiate environmental change. Responsible investors following this approach primarily assess companies based on their corporate social responsibility efforts and want to see their own moral values reflected in their investment decisions (Hill et al., 2007).

According to Sparkes and Cowton (2004) SRI - also referred to as ethical investment - has grown into an investment philosophy over the last decade. Its origins go back to the 1940s and were largely influenced by the ethical considerations of church investors (Hill et al., 2007). What started out as an investment approach of a small set of specialized investors was adopted my mainstream investment funds and gained increasing recognition (Sparkes and Cowton, 2004). According to Capelle-Blancard and Monjon (2011) especially Continental Europe has seen a large expansion of the SRI industry over the past 20 years and got ahead of the American market.

Several authors highlight the importance of environmental disclosures for the growing SRI industry (Brink and Woerd, 2004; Willis, 2003). According to Brink and Woerd (2004) due to the growing size and quantity of SRI funds there is an increasing need for comparative data. Willis (2003) confirms that voluntary reporting by organizations is an efficient supplement for more time-consuming screening methods used by the SRI industry. These include questionnaires, interviews, press reviews and the screening of other publicly available information. Brink and Woerd (2004) state that a whole industry of SRI rating agencies has developed using disclosed environmental information for their analyses, which are consequently sold to and used by investors looking for additional information to determine the performance of stocks. With this movement having gained momentum, Sparkes and Cowton (2004) describe the loop back to quoted companies to which the SRI industry is of increasing importance. SRI investors exert an influence on the companies and their adoption of more environmentally and socially conscious standards, including their reporting behavior (Sparkes and Cowton, 2004).

2.3 Consent on Reported Indicators?

This section of the literature review covers developments in the field of non-financial reporting over the past decades and literature treating specific guidelines on environmental reporting, mandatory as well as voluntary. Since the development of non-financial reporting guidelines has been largely influenced by both social and environmental concerns the review was performed in the context of the wider discussion about sustainability reporting.

2.3.1 Development of CSR Reporting

Reporting on CSR reappeared in the late 1990s after a twenty-year period of little interest in CSR related matters (Nehme and Wee, 2008). Several authors have stated that around the year 2000 CSR reporting experienced an upsurge (Bakhtina and Goudriaan, 2011; Kolk, 2004; KPMG, 2011; Nehme and Wee, 2008). Non-governmental organizations and other stakeholders exercised pressure towards large companies (Kolk, 2010). According to Nehme and Wee (2008) an internationally growing concern for climate change as well as corporate irresponsibility, evident in large scandals such as Enron, made the case for corporate responsibility around the millennium.

Bartelmus (2003) points out that in the 1990s several indicators covering social and environmental concerns existed. They had developed largely out of the understanding that purely financial indicators had flaws such as neglecting environmental externalities and their social costs. The indicators where hence meant to capture the negative effects of economic activity (OECD, 2001, Moldan et al., 1997; United Nations, 2001). Bartelmus (2003) does however state that comparability and aggregation problems remained, which was supported by the Coalition for Environmentally Responsible Economies (CERES), who found little consent with the existing guidelines and reporting requests (Bartelmus, 2003; Kolk, 2004; Brink, 2004; Willis, 2003). Indicators lacked consistency and differed from country to country and from company to company (Dubbink et al., 2008). Brink (2004) argues that a large variety of approaches led to a notion that non-financial reporting essentially adds costs and complexity.

With several authors and CERES having drawn attention to the existing difficulties for companies of answering to reporting request, choosing between various guidelines and the lacking comparability, CERES pursued and funded a global standard in cooperation with the United Nations Environmental Programme (UNEP). The Global Reporting Initiative's mission being to reform sustainability reporting towards a level of accuracy and comparability

given in financial statements. The GRI introduced a set of performance indicators to be used and specified requests and requirements (Kolk, 2004). It was designed to become a coherent framework for non-financial reporting, improving usefulness and quality of information (Dingwerth and Eichinger, 2010; Hess and Dunfee, 2007; Willis, 2003). That was to say "comparable in rigor, comparability, auditability and general acceptance" (Willis, 2003).

Indeed, the developed global standard seemed to meet a need. KPMG (2011) finds in its international study that 80% of the 250 largest companies in the world (G250) and 69% of the 100 largest companies in each of the 34 studied countries (N100) use a version of the GRI guidelines for their CSR reporting in 2011. Compared to the previous study from 2008 this marks an increase from 77 to 80% for the G250, making it the dominant standard among large corporations and leaving company developed as well as national criteria and other guidelines behind (KPMG, 2011).

Despite the high international acceptance of large organizations critical voices remain, judging the GRI guidelines as being very complicated, not precise enough and as insufficiently increasing the meaning of the non-financial performance and information (Kolk, 2004; Brink, 2004). Progress has however been acknowledged by several authors. Dingwerth and Eichinger (2010) note the development of the GRI guidelines, which were first only designed to address the environmental dimension of sustainability, but in 1998 decided to have social and economic dimensions included. Further, the introduced sector supplements, specifying reporting needs for specific business sectors, are understood as a major improvement (Dingwerth and Eichinger, 2010).

Several authors indicate that other internationally recognized standards remain and continue to evolve. A common standard is the Eco-Management and Audit Scheme (EMAS), a voluntary reporting scheme predominantly used in the European Union. Emtairah (2002) states, that it facilitates the integration of environmental values and issues in companies. It is used to continuously improve environmental performance. Cormier and Magnan (1999) consider EMAS to be a credible framework for public environmental reporting. Next to EMAS and the GRI, standards such as the UN Global Compact, ISO 14031, the Sullivan Principles, the ICC Business Charter for Sustainable Development, the WBCSD Eco-Efficiency Metrics as well as the Social Accountability standard, SA 8000, provide valuable guidance for voluntary CSR performance measurement (Nehme and Wee, 2008; Keeble et al., 2003; Brink, 2004).

2.3.2 Mandatory versus Voluntary Environmental Reporting

Environmental reporting can be both mandatory and voluntary. Currently most environmental reports are on a voluntary basis, but more mandatory reporting is expected (Emtairah, 2002). Most European countries pursue transparency policies based on self-governance, but market forces are pushing (Dubbink et al., 2008). Literature on mandatory disclosure often takes the form of descriptive studies or studies directed at policy makers (Akerman and Peltola, 2012; Emtairah, 2002; Weil et al., 2006).

Dubbink et al. (2008) argue, that the current voluntary transparency level is still insufficient. They find, that management will not disclose data that might have a negative effect on the company's stock performance. The United Nations Environment Programme supports the development of public mandatory environmental accounting, arguing that is promotes cleaner production and improved corporate accountability (SustainAbility and UNEP, 1998). Public pressure for mandatory environmental reporting existed already in the late 1990s. Emtairah (2002) identified two reasons behind this movement: One being the problem of low comparability, the other that of reporting companies being perceived as disadvantaged.

Akerman and Peltola (2012) argue that, in order to include environmental concerns in management decision making, not only changing the way of thinking is required, but also the introduction of new accounting tools. They challenge the mere development of calculative measures and suggest that environmental accounting needs to be used as a political tool. Concerned with environmentally induced costs, risks and liabilities have been international accounting bodies. Thistlethwaite (2011) identifies accounting as a powerful practice with considerable control on companies' behavior and, along this line, the International Accounting Standards Board (IASB) with international influential standards. He states that their impact on environmental reporting has been neglected in the past. Thistlethwaite (2011) argues for the environmental implications of international accounting standards and claims that environmentalists and accountants need to understand that their goals are mutually supportive. According to Thistlethwaite (2011), accountings standards such as FAS 5 and IAS 37 partially include environmental concerns in the communication requirements.

In his review on policy actions, Emtairah (2002) critically assesses mandatory environmental reporting policies in Europe. Even though comprehensive approaches to mandatory accounting are rare in Europe, some governments have established schemes to improve public access on corporate environmental information. Emtairah (2002) mentions the Pollutant

Release and Transfer Registers (PRTR) as an example for such disclosure in Europe. He states that disclosure policies in line with CSR reporting structures are uncommon. Basic information on energy however is required under the policies in North European countries investigated by Emtairah (2002). Emtairah (2002) comes to the conclusion that remaining issues in mandatory environmental reporting such as a lack of credibility can be resolved mainly through voluntary changes prompted by stimulated stakeholder demand.

2.4 Current Status of Research on Environmental Reporting

This section of the literature review covers prior analysis of environmental disclosures. Literature reviewed largely takes the form of mechanistic document analysis and benchmark studies. Content analysis has been used in various studies in the field of environmental and social reporting (Hooks and van Staden, 2011). Most existing studies make no differentiation between different topics within environmental reporting and treat the section as a whole, while there is a lack of studies focusing on energy related issues. Research has been performed in different countries and regions of the world, but few studies among European countries exist. By using content analysis different research objectives have been pursued.

2.4.1 Content Analysis in the Field of Environmental Reporting

Several studies focus on the informative value of environmental reporting. Wiseman (1982) established a disclosure index, which has been used by several other authors afterwards. She measures and evaluates environmental disclosures to subsequently test the relationship between the disclosed information and the actual environmental performance of the firm. Her findings show that the voluntarily disclosed information is incomplete and no relationship between measured contents and actual environmental performance was found. Harte and Owen (1991) perform a content analysis among perceived good reporters. Their exploratory analysis leads to the finding that very little specific details are disclosed and that there is considerable room for improvement. Milne et al. (2003) also analyze the triple bottom line of NZ companies by using the UNEP/SustainAbility framework. They find a large variability in reporting practices and quality and conclude that both completeness and quality of reporting needs to be improved. In comparison with international leaders as well as on a total scale, the content quality is found to be unsatisfactory. Table 2 below summarizes the literature using content analysis in the context of environmental reporting.

Table 2: Content analysis in the field of environmental reporting

Authors	*Research question*	*Country*	*Method*	*Tool*	*Broad approach*
Hooks & van Staden (2011)	Assess result from different content analysis methods applied to environmental reporting	New Zealand	Document analysis (multiple media)	Volume count (sentence and page), disclosure quality index, quality score per sentence	Mechanistic with interpretive
Cowan et al. (2010)	Cross-sectional analysis of reporting practices according to different criteria	Global	Benchmark Study	Own guidelines	Interpretive
Beck et al. (2010)	Detect mechanistic reporting differences and whether information content or character of reporting has changed over time	Germany, UK	Document analysis	Content categorization, disclosure quality index, volume count (sentence and word)	Interpretive with mechanistic
Jose & Lee (2007)	Investigation of environmental management practices and policies as disclosed on their websites	Global	Document analysis	ICC and GRI guidelines	Interpretive
Van Staden and Hooks (2007)	External ranking vs. quality and information content of environmental disclosures	New Zealand	Benchmark study	UNEP/SustainAbility guidelines and other studies	Mechanistic
Coupland (2006)	Role of stand-alone reports for non-financial information disclosure among banks	Inter-national	Discourse analysis	Disclosure categories initially deducted from literature, but then evolved inductively	Interpretive
Patten & Crampton (2004)	Exploration of use of webpage to communicate environmental information to stakeholders	USA	Document analysis (multiple media)	Disclosure index based on Wiseman (1982)	Mechanistic
Milne et al. (2003)	Triple Bottom Line reports in NZ and how they score with their reporting	New Zealand	Benchmark study	UNEP/SustainAbility guidelines	Mechanistic
Campbell (2003)	Environmental disclosures as a means of legitimizing corporations	UK	Document analysis	Volume count	Mechanistic
Cormier & Gordon (2001)	Relationship between company disclosure, size and ownership	Canada	Document analysis	Disclosure index based on Wiseman (1982)	Mechanistic
Wilmshurst & Frost (2000)	Perception of importance of environmental issues and actual environmental disclosure	Australia	Document analysis	Volume count (sentences)	Mechanistic
Harte & Owen (1991)	Disclosure practices of perceived good reporters in the UK	UK	Document analysis	Dichotomous disclosure index	Mechanistic
Wiseman (1982)	Relationship between environmental disclosure and environmental performance	USA	Document analysis	Two-dimensional Disclosure Index: 4 main themes and 18 categories & information content score	Mechanistic with interpretive application

Source: Adapted from Beck et al. (2010)

Another popular objective is to test the legitimacy theory in the context of environmental reporting (Campbell, 2003; Cormier and Gordon, 2001; Wilmshurst and Frost, 2000). Legitimacy theory is based on the idea of a social contract between the stakeholders and the organization and the assumption that organizations are willing to fulfill their stakeholders' expectations (Cowan et al., 2010). Cormier and Gordon (2001) make a distinction between publicly and privately owned companies when analyzing the content of social and environmental disclosures. They find that ownership structure, as well as size of a company, influence the reporting behavior. In particular, large and publicly owned companies are found

to disclose a higher amount of information, which Cormier and Gordon explain with the legitimacy theory. Campbell (2003) studied UK companies in five different sectors. He argues that legitimacy theory can explain the detected variability in reporting behavior on environmental disclosures between the different sectors. Similarly, Wilmshurst and Frost (2000) wanted to determine whether there was a relationship between reporting practices and motivational factors for management. Legitimacy theory was found to have limited support as an explanatory link between actually disclosed information and the perceived importance of some factors in the management decision process.

Other studies focus more on the means of disclosure. While passages in annual reports and stand-alone reports are fairly established, the role of web-based information is considered to be evolving (Coupland, 2006; Jose and Lee, 2007). Patten and Crampton (2004) argue that environmental information disclosed on the web essentially adds no information to other forms of reporting and cannot be understood as a move towards greater accountability. Another study focusing on wed-based disclosure was performed by Coupland (2006), who investigates websites of banks with respect to CSR communication. She pays special attention to the location of data and language used. According to Coupland (2006) simple articulation is found to be no longer sufficient. Jose and Lee (2007) investigate the depth of environmental management policies using content analysis on web disclosures. They conclude that companies worldwide are more sensitive to environmental issues than in the past, but still lack appropriate measures and structures to control environmental performance.

In contrast to the other studies performed, Cowan et al. (2010) focus on energy related disclosure as a sub-theme. They analyze disclosure according to several indicators and compare the disclosures across industries. Energy management and conservation is found to be relevant in most industries, but Cowan et al. (2010) note, that for all indicators, companies tend to shape their own definition of sustainability.

2.5 Summary

The reviewed literature reveals that most studies in the field of non-financial reporting and performance indicators are investigating environmental reporting as a whole, paying little attention to energy. Many authors pursue an explanatory approach, attempting to identify motivations for the collection and reporting of environmental data, rather than examining the content. Existing cross-sectional comparative studies are predominantly mechanistic and

while they provide a benchmark opportunity for companies, they lack actual information on best practices concerning meaningful indicators.

Reporting has become more common, but is still largely voluntary and hardly comparable. A question arising is whether the collection and reporting of data on energy and energy efficiency can be improved. Some authors have indicated that screening agencies, their clients and the companies themselves would benefit from standardized but sector-specific indicators. This study is focusing on energy indicators and attempting to determine commonly used indicators. It aims at identifying best practices in different industries by assessing and comparing the disclosed indicators with respect to energy. The influence of the GRI and other popular frameworks is taken into account. This is done in order to determine the current state of energy reporting and to give guidance to companies.

3 Methods

The following section introduces the methods used in order to systematically compare and analyze the types of energy indicators used in practice. The aim is to identify energy indicators used and to highlight similarities and discrepancies within and among different industry sectors. Further, the identified indicators will be assessed to determine their value for internal and external data users.

For answering the research question this study combines a qualitative academic research structure with some quantitative elements. This mixed-method approach is less well known than the purely quantitative or qualitative approach, but, according to Creswell (2009), is gaining recognition. He defines the mixed method approach as an attempt to combine the quantitative and qualitative approach in order to improve the overall strength of a study. Since the research question requires the processing of both, text and numeric data, this approach was found appropriate for the study.

3.1 Research Design

According to Yin (1994), the research design for a study is meant to provide a framework for the research process, including the collection and analysis of data. Different approaches exist. Bryman and Bell (2011) introduce five major research designs used in the context of economics and business studies: experimental, case study, comparative, longitudinal and cross-sectional design, all of which can be used for qualitative as well as quantitative research.

An *experimental* research design requires a high level of control and is often considered very rigorous (Trochim and Donnely, 2008). The design is typically used in quantitative research, but some exceptions exist (Bryman and Bell, 2011). It can lead to a very high level of internal validity and is known as the touchstone that any other research design is compared to. However, according to Bryman and Bell (2011), the difficulty to attain the necessary level of control is the reason that it is not very common in business research. *Case study* design on the other hand is far more popular in business studies. It entails a description and analysis of one or more cases. This design is generally used when very complex and particular problems are studied and is especially suitable to generate answers to the question ‘why?’ (Saunders et al., 2003). The *comparative* research design involves the direct comparison of two or more cases and often takes the form of cross-cultural or cross-national research (Bryman and Bell, 2011).

It is hence useful, when by contrasting cases one can better understand certain phenomena. Further, the *longitudinal* research design is usually used to mark changes over time. It involves the collection of data over a selected time period and is therefore found to be relatively costly and time-intensive (Bryman and Bell, 2011). Finally, in *cross-sectional* research design data on more than one case is collected at a single point in time. It is used to examine variations and compare factors, for example between organizations or nations (Saunders et al., 2003). Research methods associated with cross-sectional design are social surveys, structured observations and content analysis.

Comparative design and cross-sectional design have a certain overlap, according to Bryman and Bell (2011), who state that for comparative design, data can be collected in a cross-sectional design format. Methods used are also partly equivalent, but content analysis is mostly used in the context of cross-sectional research. Since this study aims to both compare and examine variations in order to identify predominant energy KPIs and to assess the content in terms of diversity and quality, both designs were combined.

3.2 Data Collection

According to Zigmund (2003), in line with the different research approaches several methods of data collection exist. Bryman and Bell (2011) introduce the following qualitative data collection methods: ethnography and participant observation, interviewing, conducting focus groups and the collection and analysis of documents.

For the purpose of this study the collection methods of interviewing and the collection and analysis of documents are both valid alternatives. Interviews however pose significant time and cost constraints and might result in a smaller data set. Documents, on the other hand, are widely available in paper as well as online. The use of such documentary secondary data, data that has initially been collected for another purpose than the research, fulfills the objectives of fact-finding and model building, according to Zikmund (2003). Clearly, the different forms of documents existing, such as personal and public documents, mass media and virtual outputs and official documents from organizational sources, hold a vast quantity of information and can lead to a large data set (Saunders et al., 2003).

3.2.1 Organizational Documents

Organizational documents have several advantages as data types for this study. According to Creswell (2009), these documents enable the researcher to obtain data in the words and language of the subject studied. Further, organizational documents have usually been

carefully revised and the publisher has given thought and attention to compiling them. A disadvantage mentioned by Creswell (2009) and Bryman and Bell (2011) is that the people writing the documents may not be equally articulate and have a particular point of view, which they want to bring across.

Organizational documents can be split into the categories of internal and publicly available documents. Internal documents include minutes of meeting, memos, sales invoices, company regulations, budget control sheets and many more. Publicly available documents on the other hand can be understood as a direct communication by the company and include annual reports, information disclosed on the web, mission statements, press releases, advertisements, reports to shareholders and other stakeholders and transcripts of speeches (Bryman and Bell, 2011).

Information on key performance indicators is likely to be found in both, internal and publicly available organizational documents. While internal data on KPIs is supposedly very accurate and reliable, gaining access to these documents is challenging. Apart from being time-consuming, the collection of the data may proof difficult due to being protected and unavailable to the public. Publicly disclosed information on the other hand is more accessible, can be obtained rapidly and - in the context of KPIs – is likely to reflect internal data. Saunders et al. (2003) further mention the advantage of data permanence in the context of publicly available documentary secondary data. Due to this reasoning sources for this study's data collection were publicly available documents in the format of environmental or CSR reports, printed or online, websites as well as annual reports. For companies reporting in various formats, the document with the most extensive reporting was used. In line with the cross-sectional research design of this study, documents screened were all valid for 2011, to reflect the most recent status of reporting. Non-financial disclosures for 2012 were not available at the point in time the study was performed. A further problem was that not all of the companies published their information in the English language. In that case the English language translations were used.

3.2.2 Data Extraction

Data collected by this mean can be either quantitative or qualitative. Since this study aims at comparing definitions and explanations of chosen energy KPIs, the data collected was initially qualitative. Trochim and Donnely (2008) define qualitative data as:

Data in which the variables are not in a numerical form, but are in the form of text, photographs, sound bytes, and so on (142).

They do however draw attention to the fact that qualitative and quantitative data are related to each other and that they can be expressed in both forms. The documents chosen according to the criteria mentioned above were thoroughly screened for energy related data and indicators in the form of text. The study is looking at how companies define and describe these indicators and not at the actual usage of energy in numerical form.

3.3 Sampling

This study's purpose is intentionally directed at findings within a certain population and not to make general numerical inferences with the means of randomly selected data. For the process of sampling a non-probability method was chosen. More specifically judgment sampling, also known as purposive sampling, was used (Zikmund, 2010). Reasons for the choice being the intent of the study, which is to not only compare, but to ultimately identify best practices. Given the time and cost considerations, purposive sampling in combination with quota sampling was found to ensure an appropriate sample, including companies comparable in size and stage of reporting as well as in an energy intensive industry. According to Zikmund (2003), the first stage in the selection of a sample is to define a target population.

3.3.1 Defining the Target Population

The target population of this study is European large companies. The geographical area was chosen due to frequent mentioning in the literature of the comparably high rate of environmental reporting and commitment from a company perspective as well as the strong interest of investors and growth of the SRI industry, which has developed in Europe (Capelle-Blanchard and Monjon, 2011; Hill et al., 2007; KPMG, 2011). According to Brink (2004) European companies showed the highest level of environmental and social reporting. They showed particular process in reporting and high awareness of climate change. Further, Centindamar et al. (2007) found that European companies had the highest participation rate in the UNGC. Another finding, which has been supported by several authors, was that especially large companies engage in environmental reporting and publish indicators. These conditions led to large European companies being a population of interest to investigate when looking at energy KPIs.

3.3.2 Selecting the Sample

When selecting the sample, several successive stages of sampling were conducted. Sampling units have been identified as proposed by Zigmund (2003). The primary sampling units, the first group of elements subject to sampling, consisted of European countries. The next step was a selection of industries forming the secondary sampling units. Finally, the tertiary sampling units were the companies.

For a selection among the primary sampling units time considerations led to a limited number of European countries being included in the study. They were collected out of a dataset based on information provided by the World Bank. Since the study aims at comparing large companies, very small countries could be excluded. Further, for the purpose of equal economic conditions for the companies, countries with high gross domestic products were chosen. At the time of the study the latest data available was from 2011. Therefore, the five largest countries based on GDP (in current US Dollars) normalized with respect to midyear population in 2011 were chosen for the study.

For the secondary sampling units industries have been chosen, since according to Beck et al. (2010), they have a considerable influence on disclosure practices. The reasoning behind the purposive selection of certain industries was to identify those, which are energy intensive in their operating processes, since the study focuses on energy KPIs. It has been shown that relatively energy intensive companies will assign increased attention to choosing, collecting and reporting good and meaningful energy KPIs (Halme and Huse, 1997). Other industry sectors such as service industries on the other hand consider energy as one of the less important inputs for production and will not necessarily link energy targets to their organizational objectives. They are therefore less likely to consider energy indicators to be key performance indicators within their organizations. Cowan et al. (2010) identify drugs and biotechnology as well as utilities as industries, which focus on energy management. Utilities can thereby be understood as any services, which provide the public with necessities such as electricity, natural gas, water and telephone communication. A third industry sector chosen is the transport sector including air, railway and land transport of passengers and freight.

To identify a target frame for the tertiary sampling units, the companies' revenue rankings in each country from a recognized national source were chosen. Excluded were affiliate companies where the holding is situated in another country in order to eliminate the possibility that a company is nominated more than once. Since company size was found to be

positively related with disclosure behavior (Beck et al., 2010.) and to ensure a sample comparable in size, the largest five representatives of each industry in each country according to sales revenue were selected. A list of the sample taken can be found in table 3 below.

Table 3: List of sampled companies

Industry / *Country*	*Chemicals & Synthetics*	*Transport*	*Utilities*
Germany	BASF SE Bayer AG Henkel AG & Co. KGaA Linde AG C.H. Boehringer Sohn AG & Ko. KG	Deutsche Lufthansa AG Deutsche Bahn AG Dachser GmbH & Co. KG Hapag-Lloyd AG Berliner Verkehrsbetriebe	E.ON SE Deutsche Telekom AG RWE AG EnBW AG VNG – Verbundnetz Gas AG
France	Sanofi L'Oréal SA L'Air Liquide Arkema Total Petrochemicals France	SNCF Air France-KLM Bolloré CMA CGM RATP	GDF Suez S.A. Électricité de France S.A. France Telecom S.A. Véolia Environnement S.A. Vivendi S.A.
United Kingdom	GlaxoSmithKline plc AstraZeneca plc Johnson Matthey plc Reckitt Benckiser Group plc BP Aromatics Ltd.	FirstGroup plc British Airways Network Rail Ltd. John Swire & Sons Ltd. EasyJet plc	Vodafone Group plc SSE plc Centrica plc BT Group plc National Grid plc
Italy	Eni S.p.A. Menarini Mapei S.p.A. Bracco S.p.A. Chiesi Farmaceutici S.p.A.	Ferrovie dello Stato Italiane Alitalia S.p.A. Snam S.p.A. Grimaldi Group Fratelli Cosulich S.p.A.	Enel S.p.A. Telecom Italia S.p.A. GSE S.p.A. Edison S.p.A. A2A S.p.A.
Russian Federation	Nizhnekamskneftekhim Inc. Uralkali Protek Group SIA International Group Akron Group	JSC Russian Railways Transneft JSC Aeroflot – Russian Airlines Freight One Gazprom JSC	Mobile TeleSystems GEET OJSC Svyazinvest OJSC Rostelecom OJSC VimpelCom MegaFon

Source: Own Illustration

3.4 Analytical Approach

The appropriate analytical approach is determined by the characteristics of the research design and the nature of the data collected, according to Zikmund (2003). An analytical approach associated with cross-sectional research design and appropriate with respect to the data collected is, as proposed by Bryman and Bell (2011), content analysis. Content analysis can arguably be qualitative, quantitative or both (Trochim and Donnelly, 2008). While quantitative content analysis, according to Bryman and Bell (2011), is aiming to quantify the content in the form of predetermined categories, qualitative content analysis seeks to identify patterns in texts and to discover underlying themes without necessarily quantifying them.

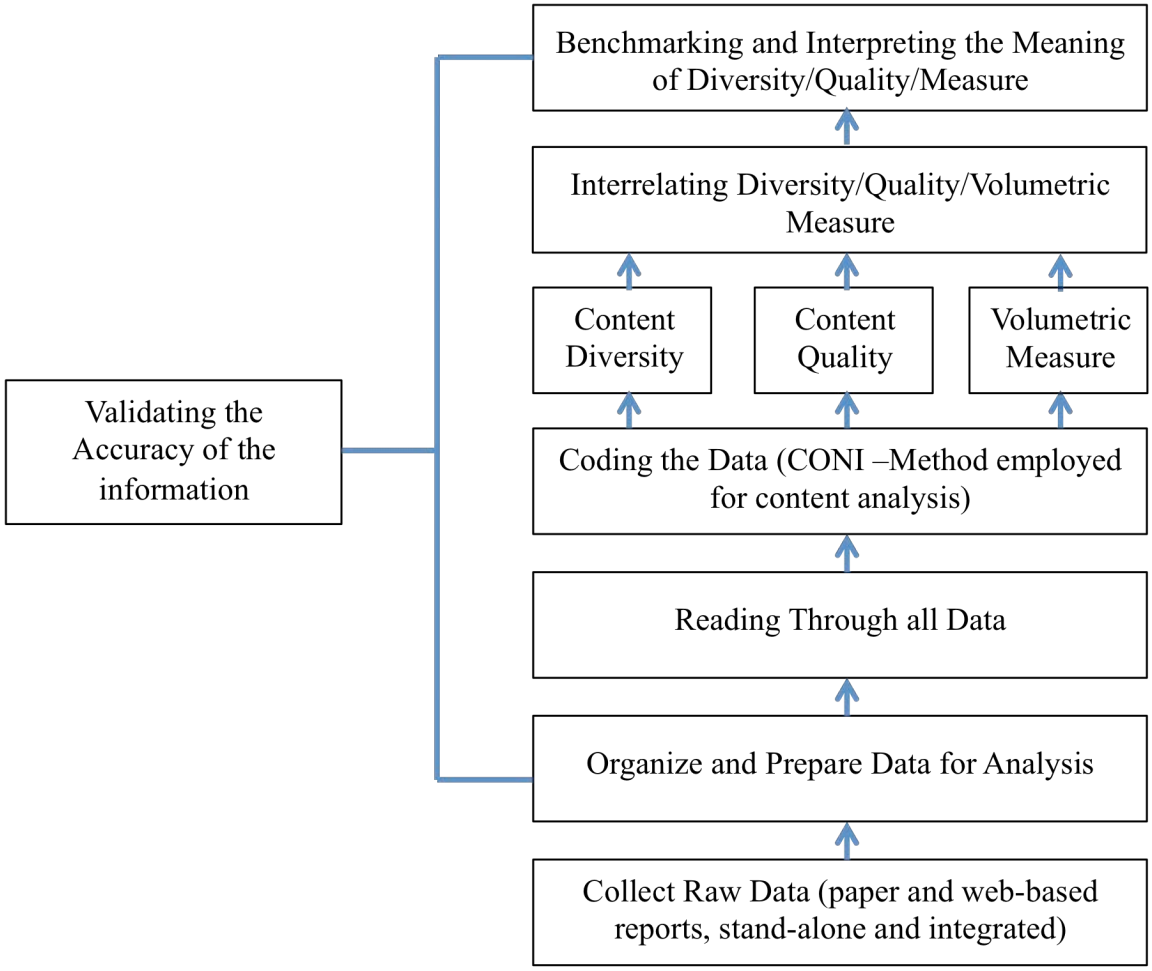
Hsieh and Shannon (2005) distinguish between three types of qualitative content analysis: conventional content analysis, directed content analysis and summative content analysis. All of them are meant to interpret meaning from the content of a text. According to Hsieh and Shannon (2005) conventional content analysis is an approach where the data 'speaks for itself'. Instead of applying complex theory or coding schemes it entails a review and discussion of the data and can lead to model building. It therefore follows an inductive research approach, where theory follows the data (Saunders et al., 2003). Directed content analysis on the other hand is motivated by a particular model or theory, following a deductive approach. Finally, in summative content analysis the data is summarized through a process of counting terms or phrases, while further meanings inherent in the data are identified (Hsieh and Shannon, 2005). The directed content analysis is considered not suitable for this study due to its deductive approach. It is not the purpose of the study to prove a theory. Both the conventional and the summative content analysis can however be used for an inductive study and have elements serving the purpose of this study. Letting indicators 'speak for themselves as well as summarizing and identifying further meaning in the data can help identify energy KPIs and assess them.

Content analysis has repeatedly been used for the purpose of understanding disclosure practices (Beck et al., 2010; Hooks and van Staden, 2011). While the qualitative types of content analysis described above have certain advantages, Beck et al. (2010) introduce a mixed method to assess the quality of reporting. The so-called CONI-method combines qualitative and quantitative content analysis. CONI stands for consolidated narrative information and the authors state that it enables the user to integrate mechanistic as well as interpretive approaches. Beck et al. (2010) first used the method in an introductory paper where they performed pair wise comparisons of environmental disclosures by companies in the United Kingdom and Germany. What distinguishes the CONI method from other methods of content analysis is its matrix approach. Beck et al. (2010) suggest three steps in the process of content analysis. The method was developed in order to capture content diversity, content quality and scale and finally using volumetric measurement. Given the nature of the data collected, as well as the nature of the study's research question, attempting to compare the diversity of indicators and to assess their quality, the CONI method was found helpful for the research and chosen to support the analytical approach.

According to the steps suggested by Creswell (2009), the study follows the data analysis approach shown in Figure 1 below. First, the raw data in form of documents for the sample is

collected and translated where necessary. Second, the data is organized and prepared for the analysis, including some first statistic overviews. Third, the data is carefully read to get a sense of the whole and screened.

Figure 1: Data analysis



Source: Adapted from Creswell (2009).

Fourth, the relevant data is coded according to the three steps proposed by Beck et al. (2010). This includes the capturing of sub-categories in the field of energy KPIs, the coding by a diversity of themes, which can be found in Appendix 2. Next, the evaluation of the content in form of information content and character follows (Beck et al, 2010). The coding is performed on a scale of 1 to 5, 1 being the least informative and 5 being informative in a narrative, quantitative and qualitative way. The full coding scheme can be found in Appendix 3. The last part of the CONI-method is the volumetric measurement, an addition to the two qualitative measurements described above. It entails the volumetric count of sub-categories recorded in words and phrases in order to draw some conclusion on the importance of the category to the company. After the coding according to the CONI-method the three outcomes

per firm are related to each other. As a final step, the findings are benchmarked within industries and between industries.

During all the steps of processing the data, the accuracy of the information is constantly validated, by comparing with the original data set. This data analysis approach described shall enable the author to identify pre-dominant themes and definitions of KPIs and to assess the quality of the indicators.

3.5 Reliability and Validity

Reliability is concerned with the consistency of a concept or measure. This implies that a measure used needs to be stable over time, possess internal reliability and be consistent (Bryman and Bell, 2011). As noted by Creswell (2009), reliability is harder to achieve in qualitative studies than in quantitative studies, but procedures to increase the reliability of a mainly qualitative study exist. In order to ensure reliability in this study the following procedures suggested by Gibbs (2007) have been followed. The data has been checked regularly throughout the process for mistakes made during the transaction. The definition of codes has been determined at the beginning of the research process and was used in the same manner on all data. Additionally, examples were used to deepen the understanding of each code definition to improve internal reliability. Further, as proposed by Yin (1994), all steps of the procedure have been documented as to ease the process of replicating this study.

This study has been an individual research project, limiting the need to coordinate the communication among coders and hence the occurrence of misunderstandings during this process (Gibbs, 2007). This also implies however, that biases and errors in the process of coding cannot be ruled out. The fact, that a single researcher is more prone to make these errors is accepted as a limitation. Given the procedures followed to ensure reliability it can be argued that a satisfactory level is reached.

Another important aspect of a research study is to ensure its validity. According to Trochim and Donnelly (2008), reliability and validity are closely related. Apart from being measured reliably, the concept needs to be measured through the right, valid, processes. Bryman and Bell (2011) understand validity as the issue in how far the indicators chosen really measure the concept to be investigated. The most basic types of validity are external and internal validity. External validity, the degree to which the conclusions drawn by looking at a sample can be generalized back to the entire population, is limited in the context of non-probability

sampling (Trochim and Donnelly, 2008). Trochim and Donnelly (2008) also state that quota purposive non-probability sampling is likely to be more biased than comparable probability sampling methods such as stratified sampling. In the context of this study however, this kind of sampling allows for enough cases in each subgroup to make meaningful inferences and comparisons within these groups. Additionally, the purposive selection of energy-intensive industries on the one hand and companies with large sales in economically similar countries on the other hand is meant to help identify best practices. The idea behind the study in this rather new field of environmental disclosure is to identify good and meaningful energy indicators, which are most likely to be found in the samples selected. The author is however aware that the resulting indicators may not be equally well suited for all industries or smaller companies. With regard to internal validity, concerned with whether a causal relationship established holds (Bryman and Bell, 2011), this study uses a triangulation approach to ensure a satisfactory level. The CONI-method used for the coding process in the data analysis uses three different approaches to content analysis, which provide a coherent justification for the themes.

3.6 Limitations

The study performed has been subject to limitations, mostly stemming from time and cost constraints. A first limitation is the focus on three industries. The study's findings would have yielded a higher level of reliability and given more insights on the use of KPIs in European companies with more industries being included. Due to a set time frame however the collection of data for additional industries would have resulted in the level of detail to suffer. With the aim to find best practices in mind, the impact of the limitation was minimized by the use of purposeful sampling. Additionally, reporting on non-financial indicators to stakeholders is yet to be performed by companies in all industries.

A second limitation is the access to internal data on indicators. While internal data on indicators is likely to be more detailed than publicly available data, its collection poses several challenges, such as limited access to the data and confidentiality agreements. The study uses publicly available documents as a proxy. Even though some information might get lost, this choice offers several advantages as well. In the case of KPIs, publicly available documents can be understood as good proxies, since the data collected for these documents is likely to be used internally as well. Further, the non-respondent error could be minimized while at the same time this type of data collection is an unobtrusive process.

Thirdly, the data collection had to be limited to large companies due to the public availability and comparability of data. The inclusion of small-to medium sized companies could again have led to a higher level of reliability for a larger population. However, as could be identified during the literature review, smaller companies are less likely to publicly report on non-financial indicators at this point in time.

A last limitation was posed by language constraints. While the majority of the sampled companies published reports and web-based information in the English language, some information could only be found in the national language. Even though the data has been translated some meaning may have been lost in the process. Due to the coding of data into sub-groups however, these errors were minimized as much as possible.

4 Analysis and Findings

The following section presents the data analysis and the findings of the research conducted. In order to adequately answer the research question –

Which energy key performance indicators do large European organizations predominantly use and are these both meaningful for stakeholders and useful for the company at the same time?

- it is organized in line with the supporting research questions stated in the introduction of this study. Supporting question number 3, which is concerned with divergences in reporting between industries and countries, is answered throughout all three subsections of the analysis.

4.1 Who Reports on Energy Usage and Efficiency?

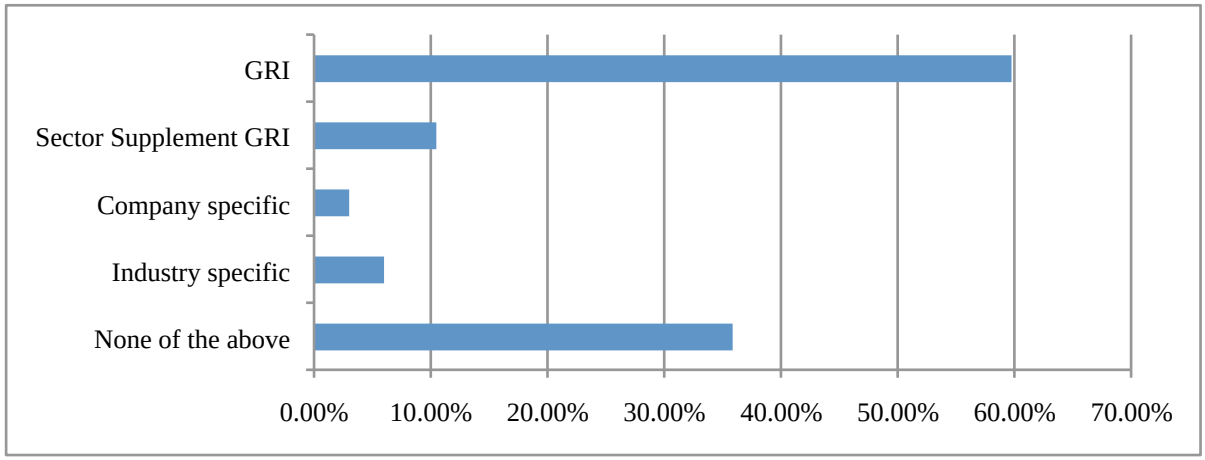
The sample of 75 companies in five countries and from three different industries revealed a strong commitment to energy reporting in Europe. The sample was comprised of large companies with different ownership structures. The majority of companies analyzed were listed (72%), with the remaining being family-owned (12%), state-owned (12%) or privately held (4%). The rate of reporting on energy-related indicators among the complete sample lay at 89.33%, with only 8 companies out of 75, who did not publish any information externally. Throughout the three different industries the reporting behavior turned out to be similarly high, supporting the conviction that among these industries best practices can be identified. A slightly higher percentage of companies reporting was found in the “Utilities” sector, while no difference existed between the sectors “Chemicals & Synthetics” and “Transport”. A larger difference could be detected across countries. While all of the UK companies published some information on energy usage and efficiency, one out of five companies in Italy and Russia did not report any information on this topic. This gave a first indication of an advanced status of reporting in Western Europe.

Among the reporting companies, several different mediums were used to publish the data. Online as well as paper versions were found to be widely accepted forms of publishing. More than 80% of all companies chose to publish information on their environmental performance on websites as well as in separate environmental or CSR reports. A smaller share of 8% pursued an integrated reporting strategy and chose their annual report as the major format of reporting on energy related indicators.

4.1.1 Reporting Guidelines Mentioned

Next to the reporting format, special attention was paid to the reporting guidelines mentioned and used by companies. In particular, the adherence to the GRI guidelines as a popular global standard was investigated, next to industry or company specific guidelines. As shown in figure 2, 59.7% of all companies reporting stated that they used the GRI framework for their disclosures on non-financial data. Several companies however explained that their reporting is not entirely based on the GRI guidelines, but that they provide a GRI index in order to simplify or allow for comparability. National differences in the rate of GRI users showed that German companies were the most frequent users (71%), while in Russia less than 42% of the reporting companies were users. The discrepancy among industries was even larger. The highest application rate was found in the "Utilities" sector, where more than 80% of the reporting companies adhered to the GRI standard. In contrast, only 23% in the "Transport" sector used the GRI guidelines and 73% in the "Chemicals & Synthetics" sector, leaving open questions about whether a global standard is equally applicable and useful for all kinds of industries.

Figure 2: Guidelines used by reporting companies



Source: Own Illustration

This lacking fit of the GRI guidelines for different industries was identified as a flaw in the literature review. Even though, to encounter this problem, tailored GRI Sector Supplements have been developed, only 10% of the companies actually took advantage of these additional guidelines. Among the tree different industries, the application of the GRI Sector Supplement was highest in the "Utilities" sector (26%). In the "Transport" sector on the other hand, none of the sampled companies made use of the pilot version for "Logistics and Transportation" available on the GRI website.

Industry specific guidelines played a minor role, with only 6% of all reporting companies mentioning an industry standard as a guiding orientation. Interestingly, this kind of orientation was exclusively found in the “Chemicals & Synthetics” sector, which seems to have organized in order to enable comparable non-financial disclosure. Roughly 36% of the reporting companies did not specifically state any guidelines as an orientation for their disclosure. It has however been observed that a fair share of the companies investigated engaged in putting their indicators and efforts into the context of international efforts and regulations.

4.1.2 Management Systems Implemented

A good indicator to show in how far companies have integrated environmental concerns and energy management into their operations are environmental management systems implemented. In particular resource efficiency can be driven by such management systems as ISO 14001 and EMAS. ISO 14001 being an integral part of EMAS, it sets the criteria for a management system. EMAS registered organizations need to report on energy efficiency indicators. Among the taken sample 57% of the companies were at least for some business divisions ISO 14001 certified. 16% of all companies were registered with EMAS. Again, the “Transport” sector lacked behind the other two sectors in terms of ISO 14001 certifications and EMAS registrations. Only 36% of all companies investigated in this sector performed the ISO 14001 certification as opposed to 72% in the “Chemicals & Synthetics” sector and 64% in the “Utilities” sector. The highest rate of EMAS registrations was found in the “Utilities” sector, where 32% of all companies applied the voluntary environmental management instrument.

4.2 What Information on Energy is Reported by Large European Organizations?

Among the companies investigated a variety of different indicators have been reported which varied from industry to industry and company to company. They had the form of ratios, terms and descriptions. All indicators collected could be grouped into two larger fields: energy consumption indicators and energy efficiency indicators. In the context of the thematic analysis the grouped indicators were further categorized according to different themes. For this purpose indicators with similar messages were grouped together and assigned a category. Different themes were more dominantly reported than others, with GRI indicators being the most popular indicators in all three industries.

4.2.1 Energy Consumption Indicators

The majority of indicators found belonged to the group of energy consumption indicators, among them, three of the five GRI indicators. These indicators had in common that they measured the companies' consumed energy, mainly in units like gigajoule (GJ) and kilowatt hour (kWh). Table 4 below gives an overview of all energy consumption indicators and the respective categories. The categories chosen were ordered from general to specific and GRI indicators can be identified due to the bold indicator name starting with EN at the beginning. A complete list of the GRI energy indicators can be found in Appendix 4.

Table 4: Energy consumption KPIs categorized

Category	*Key Performance Indicator*	*Applied in Industry*		
		Chemicals & Synthetics	Transport	Utilities
Total energy usage	Energy consumption	x	x	x
	Net purchases of energy	x		
Direct energy consumption	**EN3** Direct energy consumption by primary source	x	x	x
	Use of fossil primary source of energy			x
	Use of biogenic energy source			x
	Fuel consumption	x	x	x
	Annual thermal energy consumption	x		
Indirect energy consumption	Electricity consumption	x	x	
	EN4 Indirect energy consumption by primary source	x	x	x
Renewables	Usage of renewables	x	x	x
	Contribution of renewables to electricity generation			x
Consumption relative to output	Energy consumption relative to sales volume	x		
	Monetary Power Efficiency Index (MPEI) in which developments in energy consumption is indicated in relation to revenues			x
	Energy usage per 1000 products	x		
	Energy usage per unit of production	x		
	Evolution of energy consumption per m^3 of air gas produced	x		
	Fuel/Energy consumption (per passenger/per freight)		x	
Energy savings	Energy savings	x	x	x
	Annual electricity savings		x	x
	EN7 Initiatives to reduce indirect energy consumption and reductions achieved	x	x	x
Energy used for transportation	Absolute primary energy consumption of journeys		x	
	Evolution of distance traveled per ton of gas delivered	x		
	Average energy for train operation (KWh/km and l/km)		x	
	Distance traveled	x		x
	Upstream consumption/loss	x		

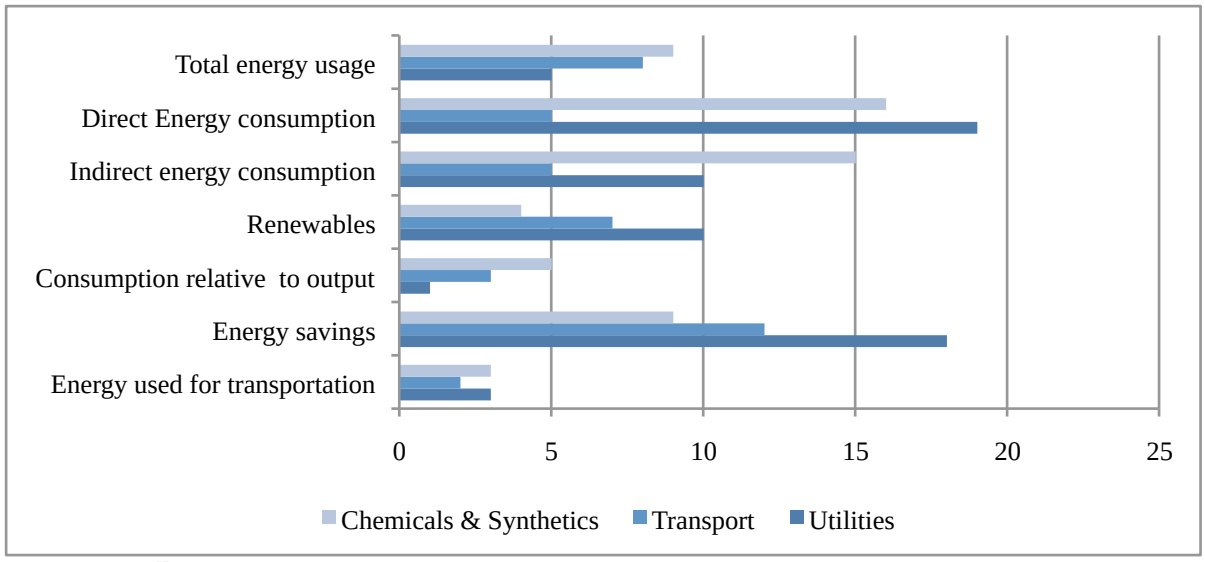
Table 4 further specifies which energy consumption indicators have been found in the "Chemicals & Synthetics", "Transport" and "Utilities" sector. As can be seen, the most general indicators make no differentiation between direct or indirect energy consumption, nor do they relate the consumption to output or a specific operation. They do however capture the total consumption of the company and are used in all three selected industries. Indicators in the categories *direct energy consumption* and *indirect energy consumption* provide more detail. Most of the indicators in these categories specify the source of energy consumed. Reported individually, they would however give an incomplete picture of the company performance with respect to energy consumption. An interesting field for external users of energy KPIs are *renewables* indicators. They indicate in how far the company is preparing for a shift in energy sources and can help identify how sensitive the company is to price shifts for oil or gas. This seems to be relevant for all industries investigated, since the indicator *usage of renewables* was found in all three of them. Different information is inherent in indicators, which set energy consumption in relation with the products or production processes. Accountability is a possible advantage as well as the fact that - if data is provided over a period of time - advanced or worsened production methods, saving energy and hence costs, can be inferred. Indicators of the category *consumption relative to output* are most common in the "Chemicals & Synthetics" sector, which seems logical, since it is the only manufacturing sector in the sample. The category *energy savings* consists of indicators, which specify which reductions in energy consumption have been achieved. This implies that a base line for energy consumption is chosen by the company to calculate the savings. *Energy savings* indicators are popular in all three industries as well. Finally, a very specific group of indicators is included in the category *energy used for transportation*. In contrast to the indicators treated above, these KPIs focus on a specific part of the operations. Mainly transport operators, but also companies in the other two sectors, clearly distinguish between energy consumption of their buildings and energy consumption of the transport vehicles, making a logical separation between different operating areas.

While the three GRI indicators differ in the detail they require to be disclosed, it can be observed that they are consequently applied in all three industries. Overall, 45% of all companies in the sample reported on GRI core indicator EN3, 37% on core indicator EN4 and 27% on the additional GRI indicator EN7. During the course of data extraction it could be seen however, that the GRI indicators left room for interpretation. Companies interpreted the indicators differently and provided different information they found suitable to satisfy the requirement of each GRI indicator. Some companies very specifically explained why they did

what they did and why the chosen information fit into the category. Others used the interpretive space and communicated less clearly why and how they fulfilled the indicator's information requirement.

The thematic analysis of energy consumption KPIs further showed that different themes were more commonly reported on than others. As illustrated in figure 3 *direct energy consumption*, *indirect energy consumption* and *energy savings* were the categories with the majority of disclosures. In contrast, indicators in the categories *consumption relative to output* and *energy used for transportation* were more exceptional. An explanation for this pattern is that the GRI indicators were the most commonly used ones and hence the categories including a GRI indicator had the largest sum of disclosures. The high acceptance of the GRI framework clearly influences the disclosed themes in the field of energy consumption.

Figure 3: Number of disclosures on energy consumption per category per industry



Source: Own Illustration

With respect to the industry, the utilities sector is strongest in the categories including GRI indicators, which could have been expected taking into account the high GRI application level detected earlier. Additionally, indicators with respect to renewables seem to be of higher importance here than in the other sectors. Overall, the reporting of the utilities sector appears to be concentrated on several selected themes. The transport sector on the other hand, which was found to have the lowest GRI application level, shows a more balanced picture. The reporting range is broader and less concentrated. Indicators found have a larger variety and are oftentimes rather specific. Finally, the chemicals and synthetics sector is the least concerned with indicators in the *renewables* category, possibly since this topic is further away from the core business in the industry compared to the other two industries. The sector

therefore discloses more information on *consumption relative to output*, a category, which is especially suitable for the industry since it provides products rather than a service.

4.2.2 Energy Efficiency Indicators

The second large field of indicators tries to capture the less straightforward notion of energy efficiency. The attempt to increase the efficiency of energy usage can take different forms. Table 5 below shows the categorization of the energy efficiency indicators collected as well as the application in different industries. The wording of the KPIs was kept exactly as found in the documents screened. Similarly to the findings for energy consumption indicators, actual energy efficiency indicators found varied from being very general to being very detailed and specific.

Table 5: Energy efficiency KPIs categorized

Category	*Key Performance Indicator*	*Applied in Industry*		
		Chemicals & Synthetics	Transport	Utilities
Efficiency	Energy efficiency	x	x	x
Production efficiency	Energy efficiency in production processes	x		
	Eco-efficiency indicator (service/joule)			x
Energy Savings	**EN5** Energy saved due to conservation and efficiency improvements	x	x	x
	Refining energy efficiency index	x		
	Petrochemicals energy efficiency	x		
Energy efficiency initiatives	**EN6** Initiatives to provide energy-efficient or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives	x	x	x
	Energy efficiency certificates distributed			x
	Photovoltaic installed			x
	Electronic meters installed			x
	Non hazardous waste incineration plants equipped with energy conversion systems			x
Transport efficiency	Fuel efficiency		x	

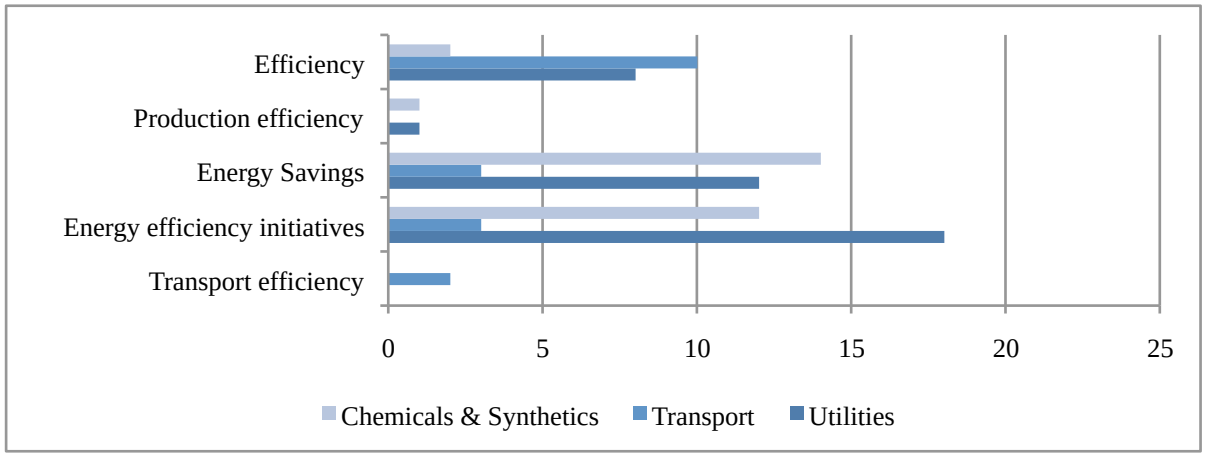
Source: Own Illustration

Along with the most general indicator, namely *energy efficiency*, only the two GRI indicators were found across all three industries. In total, 27% of all companies reported *energy efficiency* and the two additional GRI indicators were used by 37% (EN5) and 39% (EN6) of the 75 companies investigated. Within the chemicals and synthetics sector companies made a distinction between the energy efficiency in different processes. Further, different energy efficiency initiatives found were related to the introduction of renewables (Photovoltaic installed), the collection of data (Electronic meters installed), the certification of energy efficiency standards (Energy efficiency certificates distributed), as well as to energy conversion systems. The variety of initiatives suggests different understandings of the widely interpretable term of “initiative”. This term, which is at the heart of GRI indicator EN6, gives

different industries the freedom to publish actions, which are realistic and compatible with their industry sector. A comparison across industries however should be difficult. This phenomenon of industry specific indicators is also observable with the *fuel efficiency* indicator. Energy efficiency in the transport sector is mainly achievable through fuel efficiency, a concept, which is less substantial for the other sectors.

Looking at the frequency of disclosure in different categories, the differences between industries become even more obvious. Figure 4 below shows, that *production efficiency* indicators are not relevant for the transport industry, since it can be understood as a service industry rather than a producing industry.

Figure 4: Number of disclosures on energy efficiency per category per industry



Source: Own Illustration

Further, due to a lower application rate of the GRI guidelines, relatively few disclosures in the transport sector are found in the categories *energy savings* and *energy efficiency initiatives*, where the other two sectors have most disclosures. Companies in the chemicals and synthetics sector seem to prefer more specific indicators to the very general *energy efficiency* indicator. Overall, the transport sector again shows the most balanced approach to report on different energy efficiency indicators, while the findings suggest that GRI indicators largely guide the two other sectors.

4.3 To What Extent is the Reported Information Meaningful?

Given the findings on content diversity shown above, the next step in the data analysis was content quality. In order to ensure effective transparency for both, internal management and investors, the indicators need to fulfill criteria such as being informative, objective, relevant, clearly stated and comparable. While some characteristics found to be important for meaningful indicators are difficult to assess on such a large sample, the quality of the content

could be captured with the content coding introduced in the data analysis section. For this purpose, the coding scale from 1 to 5 was applied to all disclosed indicators and quality differences between themes as well as companies could be observed. The stated indicators were not necessarily supported by numbers or even comparable data over the years, but sometimes consisted of a purely narrative explanation.

As an initial overview, it could be observed, that the companies sampled achieved a relatively high quality level in their disclosures on energy KPIs. More than 2/3 of the 251 disclosures on KPIs reached level 4 or 5 and therefore combined the features of a quantitative and narrative disclosure. This means that the KPIs were informative, relevant, clearly stated and objective. About 45% of all disclosed KPIs reached the highest level and were additionally comparable over time. Purely quantitative disclosures were rarely found, constituting only 4% of all disclosed KPIs. More common were observed disclosures on level 2, where no numerical values were published and the indicator disclosure remained descriptive, but provided details. A first qualitative comparison of those KPIs with reference to the GRI framework and non-GRI indicators showed that while the proportion of highly quantitative disclosures was fairly equal, the distribution among lower level disclosures was different. GRI indicator disclosures at lower levels turned out to be more detailed than non-GRI disclosures. While most of the disclosed KPIs could be supported by numbers not all companies investigated chose to do so. Whether the data is collected internally and deliberately not made public cannot be concluded from the data. Overall transparency was however found to be high.

4.3.1 Quality of Reporting

With respect to reported indicators, the quality of reporting differed across themes. Some indicator categories seemed to facilitate or enable qualitative and quantitative disclosures. In other categories numbers in addition to a narrative disclosure rarely supported the indicators. In order to allow for a comparison of different indicator categories, a weighted average reporting level was calculated. This was done for both, energy consumption categories and energy efficiency categories. Further, in line with the notion that not all industries consider the same indicators to be meaningful and important for their decision making process, differences in the reporting quality of themes across industries could be observed.

Looking at energy consumption indicators, the quality level is generally high. Indicators in the category *consumption relative to output* were especially informative, as shown in table 6. Across all sectors, reported indicators in this category were always supported by quantitative

data, which was presented over a series of years. Indicators relating energy consumption to revenues or units produced were highly descriptive and their relevance for the company operations was clearly stated. Despite being used by only a small proportion of all companies, this indicator group carries a lot of potential. Similarly, indicators from the *direct energy consumption* category were constantly reported on a high level. This may be due to the ease of collection and the availability of this data. Together with indicators for *total energy usage* and *indirect energy consumption*, they form the group of more general indicators, requiring lesser distinctions and possibly effort in the making.

Table 6: Weighted average of reporting level on energy consumption indicators

	All sectors	*Chemicals & Synthetics*	*Transport*	*Utilities*
Total energy usage	4.27	4.56	3.75	4.60
Direct energy consumption	4.65	4.69	4.60	4.63
Indirect energy consumption	4.47	4.20	4.60	4.80
Renewables	3.76	3.50	3.71	3.90
Consumption relative to output	5.00	5.00	5.00	5.00
Energy savings	2.80	2.89	2.42	3.07
Energy used for transportation	4.50	4.33	5.00	4.33

Source: Own Illustration

More specific and hence demanding to collect and compute seemed to be indicators in the *renewables* and *energy savings* categories. Especially the latter were found to be disclosed in text format without supporting numbers in most cases, reaching a weighted average reporting level of 2.8 overall. Companies in the utilities sector had the highest proportion of higher-level disclosures on energy savings, but still only reached a weighted average level of 3.07. Overall, little industry-specific differences exist for energy consumption indicators.

In the field of energy efficiency indicators on the other hand, more contrasting findings can be observed. General indicators in the *efficiency* category were interpreted very differently across companies. In all industries, companies chose to either report on a very high level or to only roughly touch upon the topic of efficiency, leading to a weighted average reporting level of 2.85, as shown in table 7. More specific indicator categories, apart from *transport efficiency*, were consistently dealt with at a higher level. If companies chose to report them, they cared to include numbers in most cases. For indicators in the *energy efficiency initiatives* category about 31% of the disclosures were kept in text format. This can be explained by the open definition of the included GRI indicator, which seems to primarily ask for the initiatives themselves and only secondary requires numeric values concerning reductions achieved.

Table 7: Weighted average of reporting level on energy efficiency indicators

	All sectors	*Chemicals & Synthetics*	*Transport*	*Utilities*
Efficiency	2.85	3.00	2.40	3.38
Production efficiency	5.00	5.00	-	5.00
Energy Savings	3.83	4.00	4.00	3.75
Energy efficiency initiatives	3.64	3.50	3.00	3.83
Transport efficiency	2.50	-	2.50	-

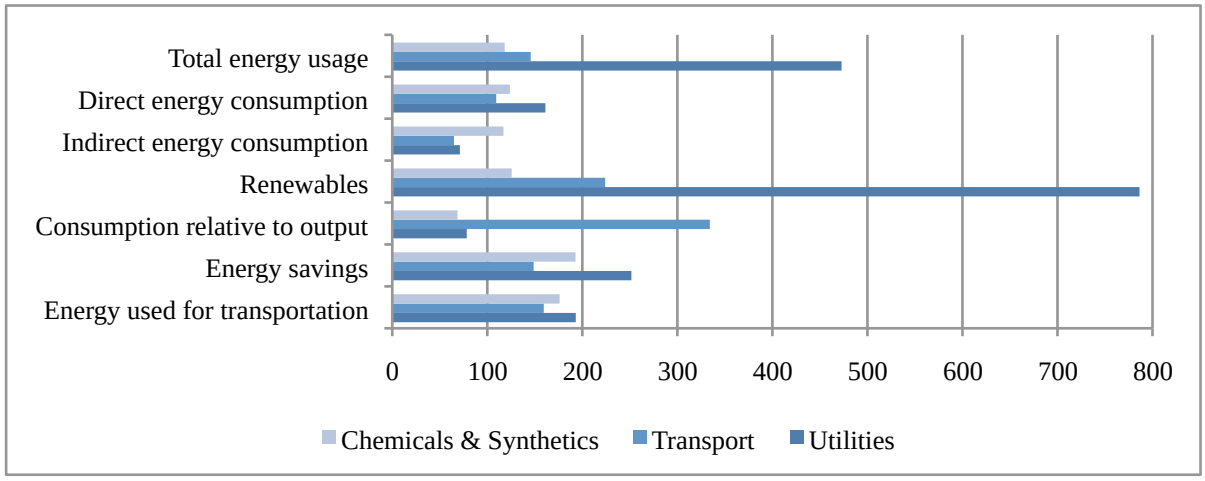
Source: Own Illustration

In a direct comparison between industries, the utilities sector shows the highest level of reporting across all energy efficiency indicators, using numbers to support claims made in most cases. Companies in the transport sector on the other hand very often remain at a qualitative level when reporting.

The quality analysis was supported by a mechanistic measure. A word count was used to determine the importance of the reported indicator for the respective company. The findings and data analysis suggest however, that in the case of energy KPIs, quantity is not necessarily related to the quality level of the indicator. It rather appears that companies who choose to not report numeric data use more text. Further, those indicators closely related to the core business are described in more detail. Finally, given the different formats of reporting, some companies are naturally more precise in their KPI disclosures than others. When integrating energy related information in annual reports, shorter explanations are required.

Figure 5 below shows the average amount of words used per KPI disclosure on energy consumption.

Figure 5: Energy consumption themes word count

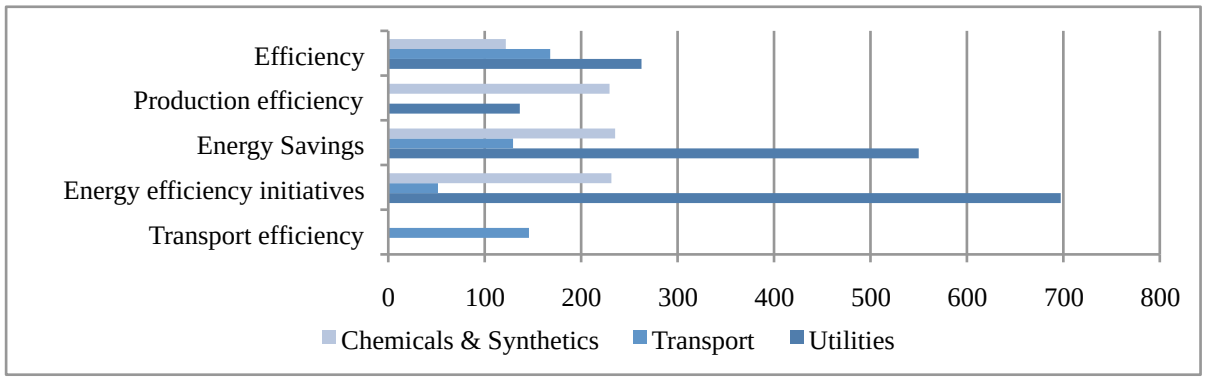


Source: Own Illustration

Very clearly, the *utilities* sector stands out, with high word counts in the majority of categories. Especially for disclosures on *renewables* and *total energy usage* companies in this sector tend to give detailed explanations. These findings support the reasoning introduced above, namely, that indicators close to the companies' core business will be treated more explicitly. For the other two sectors, disclosures on *total energy usage* have on average relatively low word counts of close to 100 words. This is also the case for other general categories with qualitatively high indicators such as *direct energy consumption* and *indirect energy consumption*. The findings suggest that the displayed numerical data is clearly communicating the indicator's message and needs not be supported by longer explanations.

Looking at the volumetric results for energy efficiency themes in figure 6, a similar pattern can be detected. For directly business related indicator categories the average word count in the utilities sector lay substantially higher than in other sectors. Especially *energy efficiency initiatives* disclosures were commented on in detail, as were *energy savings* indicators. Seemingly counter-intuitive was the low average word count for indicators in the *production efficiency* category. Given the quality content determined before, one would have expected to find the opposite, a high word count emphasizing the importance of the high quality indicators in the *production efficiency* category and fewer words for indicators in other categories. This finding supports the belief that numerically supported indicators are often self-explaining and that text may be used to make up for not published quantitative data in several cases.

Figure 6: Energy efficiency themes word count



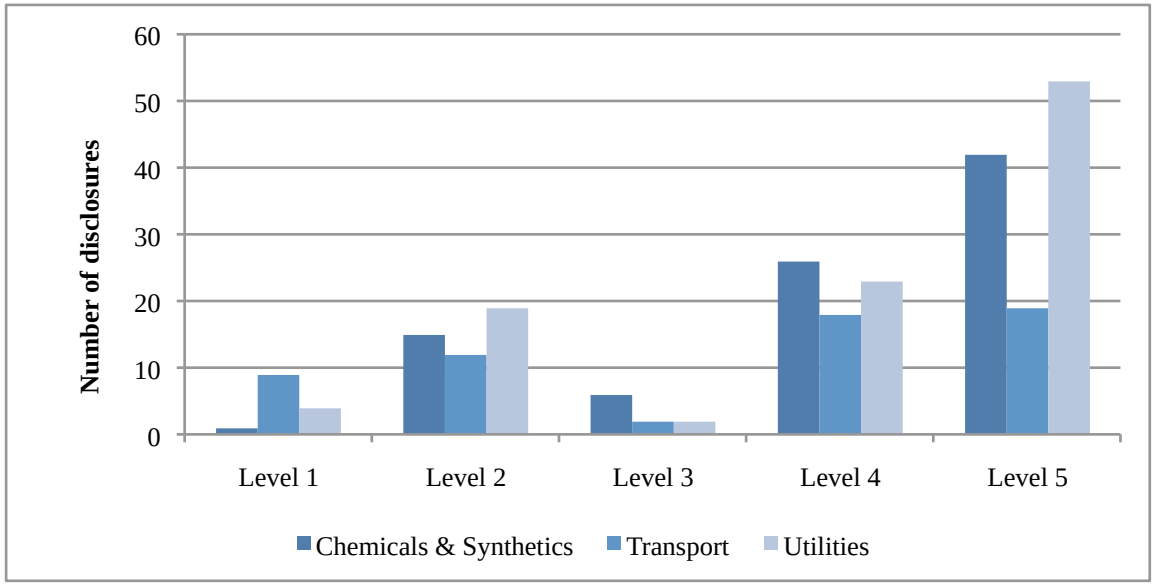
Source: Own Illustration

4.3.2 Quality Differences between Industries

Having established a difference in quality of thematic disclosures for indicators across industries in section 4.2, this section is exploring overall divergences in content quality. Looking at the disclosure volume per quality level in figure 7 the distribution immediately

confirms a high level of content quality across all industries. Nevertheless, content quality is not equally high in all industries. The sampled companies from the utilities sector display the highest disclosure volume at level 5. This suggests that comparability on top of relevance and information content is important to companies in this sector. It further demonstrates that transparency towards stakeholders on energy related issues, is considered important. Since more than half of the companies in the utilities sector are electricity or gas providers, it can be assumed that the nature of the business the companies are in influences the energy reporting behavior. Purely narrative disclosures with little detail are rare in the industry, similarly purely quantitative disclosures. The utilities companies therefore use more detailed narrative disclosures than any other industry. This may reflect that they consider some purely narrative indicators as important information for their stakeholders.

Figure 7: Industry disclosure by information content scale



Source: Own Illustration

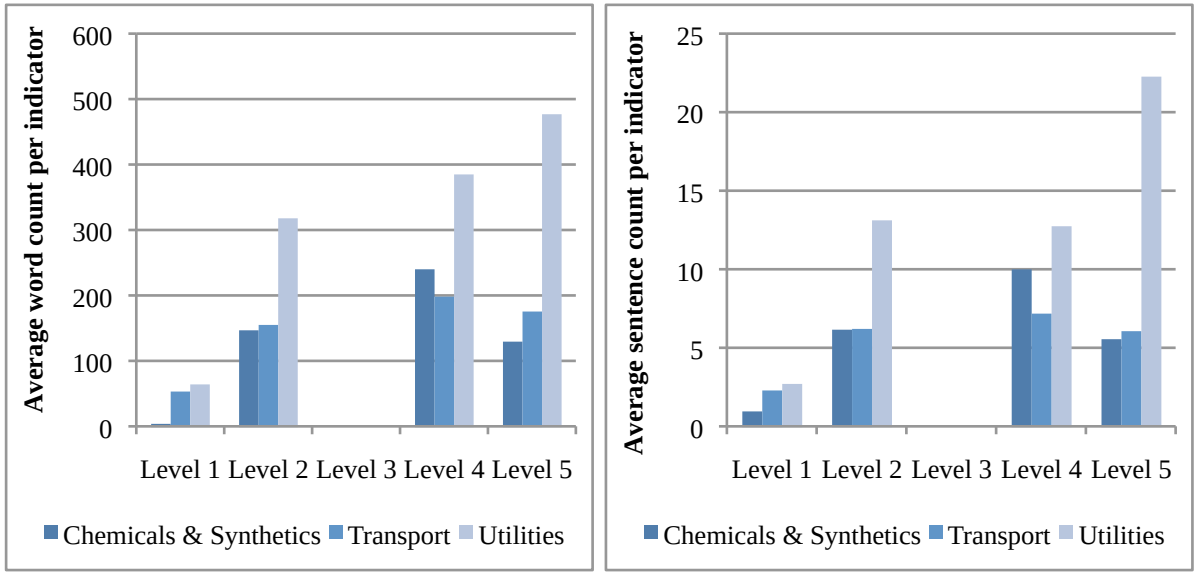
The chemicals and synthetics sector shows a similar disclosure profile. While the number of total disclosures on the highest content quality levels 4 and 5 is lower here than in the utilities sector, the relative rate is almost the same. Around 50% of all disclosures in these two industries were found to be on level 5 and more than 25% on level 4. Hence, if companies in the chemicals and synthetics sector chose to report, they favored to so quantitatively as well as qualitatively.

A different picture can be observed in the transport sector. With a similarly high reporting rate as the other two industries, one might assume that the preconditions are the same. The volumes per quality level however are not rising as steeply as they do in the other sectors.

Roughly 35% of all disclosures on energy KPIs in this sector are purely qualitatively. In contrast to companies in the other two sectors transport operators publish a large share of their disclosures at level 1 quality, providing few and oftentimes superficial information. In direct comparison with the other two similarly energy-intensive sectors the transport sector has the lowest numbers of disclosures on level 4 and 5. Apparently, comparability of data over the years is less demanded by external users or less supported by internal users. The sector also publishes the lowest number of disclosures on KPIs in total: 60 as compared to 90 for the chemicals and synthetics sector and 101 for the utilities sector.

The qualitative content analysis was backed by a mechanistic measure. The disclosures on energy KPIs were counted in terms of words and sentences used. Since the definition of Level 3 is that the disclosure of the indicator is purely quantitative, no words or sentences could be counted. For a first comparison, the average word and sentence count per disclosure level in each industry sector were calculated. The results are graphed in figure 8 below. An upward trend of words and sentences used to describe an indicator can be observed. In general, higher quality disclosures go along with a longer description or explanation.

Figure 8: Industry disclosure by volumetric measurement



Source: Own Illustration

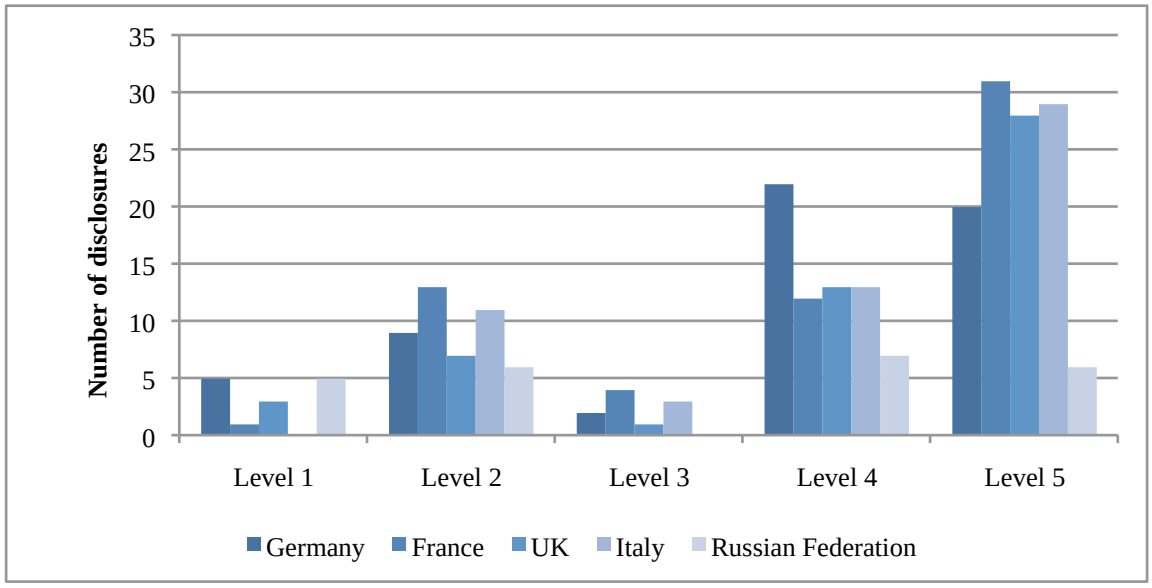
Between industries however, different reporting behaviors prevail. For the chemicals and synthetics as well as transport sector the highest level reporting (Level 5) not necessarily goes along with a lot of direct explanation. A possible reason mentioned above, is that the quantitative indicators “speak for themselves” and do not need to be explained in detail. The utilities sector on the other hand stands out, as figure 8 shows. Overall, the sector uses more

text for all disclosure levels than the other two sectors. With the core business being closely related to energy in most cases, this can be easily understood. Further, more words and sentences are used for Level 5 disclosures than for any other disclosures. This may reflect the familiarity of the topic and hence a larger need to discuss especially those indicators, which include extensive quantitative data.

4.3.3 Quality Differences between Countries

As the reporting rate differed substantially across countries, it was interesting to know whether there is a difference in the quality of disclosures as well. The findings suggest that the depth of reporting on energy KPIs is largely influenced by the company's country of origin. The sample taken consists of an equal number of companies from each industry and each country. The number of disclosures for each level in the five countries included is shown in figure 9 below.

Figure 9: Country disclosure by information content scale



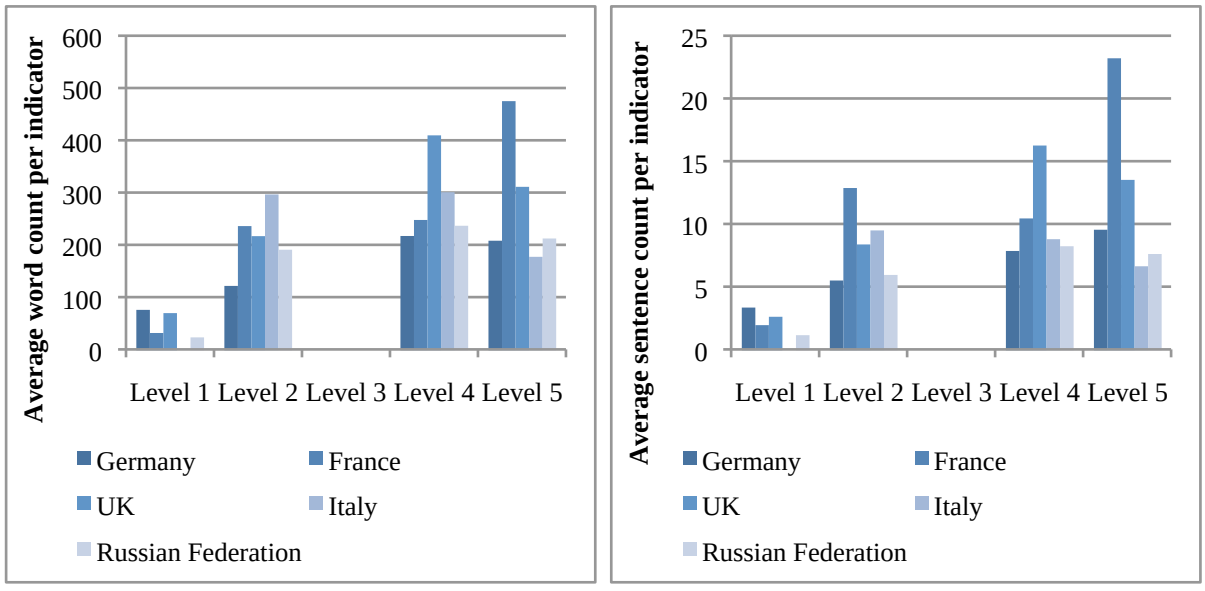
Source: Own Illustration

Not surprisingly, the total number of disclosures on energy KPIs by companies based in the Russian Federation is less than half of what is reported in other countries. The fifteen Russian companies studied together published only 24 disclosures on KPIs. Among French companies, on the other hand, 61 disclosures were counted. This finding makes inherent sense looking at the low reporting rate found for Russian companies as compared to others. Apart from the small number of disclosures, Russian companies also differ from the German, French, British and Italian in terms of disclosure quality. The disclosures on KPIs seem to be almost equally spread over all levels, indicating no particular preference for more detailed and

quantitative information. Especially state-owned and privately held Russian companies, which represented a larger share in Russia, were found to publish narrative information only and limit their disclosures to a couple of sentences, providing little detail. This suggests that the audience, in this case not being external investors, matters for reporting policies. Privately held companies have a smaller interest in making their energy data publicly available than listed companies. German, French, British and Italian companies on the other hand, display a highly sophisticated disclosure pattern. More than 40 disclosures on energy KPIs in each country reach level 4 or 5. This represents more than 70% of all disclosures on KPIs in these countries. Companies located in France seem to be especially thorough when reporting and publish the largest amount of indicators, which are qualitatively described, quantitatively displayed and comparable over a period of time. German companies have lesser disclosures on level 5, but therefore more on level 4. The notion of providing comparable data over several years in order to display a development seems to be less common than in France, the UK and Italy.

The volumetric measurement confirms the findings described above and provides some new insights. Russian companies on average were found to be providing few and rarely detailed indicators. This is also reflected by the mechanistic measure of word and sentence counts, as shown in figure 10.

Figure 10: Country disclosure by volumetric measurement



Source: Own Illustration

German companies, similarly to Russian ones, were found to keep the explanations on indicators short across all levels, using limited amounts of words and sentences. Even though

the reporting quality in Germany was found to be higher than in the Russian Federation in this sample, the average length of Level 4 and 5 descriptions was almost the same. The increase in words used between Level 2 and Level 4 disclosures however was higher. The average word count differs little across different disclosure levels. Alone very simplistic Level 1 disclosures on energy KPIs have a substantially lower word count than other disclosures by Russian companies.

The findings above suggest that the quality of reporting on energy KPIs is influenced by several factors. The ease of compilation when designing an indicator, as well as the relevance for the company's core business, are good preconditions for meaningful and detailed indicators. Apart from these considerations, other circumstances provide favorable conditions for high quality indicators. Industry pressure, apparent through benchmarking activities and industry best practices seem to have a large impact on what and how a company reports on energy. The membership in a certain industry will influence the reporting behavior. Lastly, a company's policies seem to be reflecting the direct geographical environment. The company's home country appears to make a difference, when looking at the degree of transparency and the overall quality of energy KPI disclosures.

5 Discussion

The following chapter discusses the findings of the study and brings forward the practical implications for companies' reporting policies and investors' data analysis. The role of industry and country practices will be considered in the discussion. Through the combination of existing literature and the summarized actual findings the chapter aims to formulate an explicit answer to the research question of the study.

The findings suggest that especially GRI indicators for the energy aspect, as well as very general energy indicators are predominantly used across large European companies. Further, the quality of reporting with respect to detail, comparability and transparency is very high across all three energy–intensive industries: "Chemicals & Synthetics", "Transport" and "Utilities". Both, internal as well as external users receive valuable information on energy performance, which is suggested to be closely linked to a company's financial performance.

5.1 Reporting on Energy KPIs

The disclosure of environmental information has been a rising trend, as indicated by several authors (Bakhtina and Goudriaan, 2011; KPMG, 2011). Key performance indicators in the field of energy were thereby considered particularly interesting (Allcott and Greenstone, 2012). The study's findings confirm a high-perceived importance of energy KPIs. The topic seems to be highly relevant to report within the chosen energy-intensive industry sectors. As expected and intended in the purposive sampling process, the rate of reporters in the sectors 'Chemicals & Synthetics', 'Transport' and 'Utilities' was very high, providing a good basis for the identification of best practices. Across these industries, no large differences could be found. Across countries however, a tendency to report was found primarily in Western European countries. Cultural influences as well as peer pressure cannot be neglected, when looking at reporting behavior in the field of energy KPIs.

5.1.1 Formats and Guidelines

Communication formats used among the sampled companies were in line with findings from prior research. The largest proportion used separate reports as the major format for energy related disclosures, but web-based information was similarly often used. Web-based disclosures are hence clearly popular, as suggested by Jose and Lee (2007). Both formats do not pose any restriction with respect to amplitude or depth to be reported.

The study identified two large fields of energy KPIs, those with a direct reference to energy consumption and those specifically addressing energy efficiency. Indicators found in both groups ranged from being very general to being specific and addressed direct as well as indirect energy consumption. This implies, that both, the subjects covered as well as the methodology used when disclosing, were very diversified. According to Willis (2003), a large set of indicators can turn out to be confusing for companies to choose from. To avoid this problem as well as a lack of comparability and consistency, guidelines play a considerable role. Indeed, when grouping the indicators by themes, it became obvious that a larger overlap existed. Among the guidelines named in the analyzed documents, EMAS, ISO 14001, ISO 26000 and - most frequently - the GRI guidelines were mentioned. As suggested by KPMG (2011) and others, the voluntary GRI framework has gained acceptance as a guideline for large companies. The findings support the notion that many companies make use of readily available indicators, which are internationally recognized. Not only was a high rate of reporting according to the GRI guidelines among large European companies confirmed, but also did it have an impact on the themes covered. The high acceptance of the GRI framework found in the study clearly influenced the disclosed themes in the field of energy consumption and energy efficiency.

While the GRI guidelines were highly accepted across all industries, the indicators reported under this framework were found to vary. As has been objected in the literature review by authors such as Brink and Woerd (2004), there was room for interpretation, and the GRI indicators were not necessarily clearly stated or comparable after all. A sensible explanation for this phenomenon was the lacking fit of the GRI guidelines for different industries. Since different industries deal with different challenges and operational activities, imposing the same indicators on them can be difficult. The introduction of the GRI sector supplements was supposedly a solution and meant to provide different industries with a set of additional and adapted indicators. Authors such as Dingwerth and Eichinger (2010) perceived the sector supplements as a major improvement. The remaining question was however, in how far companies adopt these sector supplements and in how far they are relevant for energy KPIs. The findings show, that the GRI sector supplements are used only by few companies and hence have a very limited influence on energy reporting at the moment. This could be either due to the novelty of the GRI sector supplements or due to their limited tangency with energy related topics.

5.1.2 Predominantly Used Energy KPIs

In line with the high rate of GRI adopters, the GRI energy indicators were the ones predominantly used across all sampled companies. Similarly often applied were very general indicators with respect to energy consumption and energy efficiency. This supports the notion suggested by Goold and Quinn (1990), namely that indicators should be simple, for the sake of comparability over time and across companies. The substantially lower number of other KPIs reported might reflect the difficulty for companies to choose more distinctive measures. While indicators that are easy to collect and calculate appear to be very cost-effective, a characteristic of a good performance indicators brought forward by Hayes et al. (1988), more specific indicators could have a high potential, which is commonly overlooked. The initial effort determining and introducing a new KPI could be the reason that many companies restrain from engaging in this matter. Further, reporting in accordance with internationally accepted guidelines such as the GRI enables them to demonstrate transparency and to provide comparable indicators.

Indeed, the GRI indicators on energy were applied across all three industries. Besides these indicators however, thematic differences across industry sectors were found, as expected by Betianu (2010) and Kolk (2004). Some more general findings of differences in reporting patterns can therefore be transferred to energy reporting. Given the nature of indicators preferred or left out by some industry sectors, it appears that relevance, highlighted by Kolk (2004), played an important role as well as expertise in the field to be reported. Especially the ‘Transport’ sector stood out. Despite the similarly high overall reporting rate, the lowest number of GRI disclosures was found in this industry. A possible explanation could be a misfit of the GRI energy indicators with the ‘Transport’ sector requirements. Since companies in this sector generally provide a service, rather than engaging in the production of goods, the business asked for different themes to be covered. Fuel consumption and fuel efficiency played a larger role than energy consumption relative to sales volume. The relevance of the specific indicator with respect to the business model of the company determined the choice of disclosed KPIs. Similarly, the ‘Utilities’ sector, including a large share of oil and gas providers, has an expertise in energy provision and at the same time in the collection of energy related data. With energy at the core of the business model, it is not surprising, that particularly detailed data was reported among ‘Utilities’ companies. Also, providing renewable energy themselves, a familiarity with indicators in the field of ‘Renewables’ is given and the high number of disclosures with respect to this theme seems natural.

While some KPIs seem to no longer lack consistency or differ from company to company, as suggested by Dubbink et al. (2008), this only holds true for some of the internationally recognized GRI indicators and a few very general ones. These predominant energy indicators have gained recognition across industries and are widely accepted. More specific indicators adapted to the industry environment and identified in the process of this study however, may have equally high potential and are just not yet spread within industries. This can be assigned to the circumstance, that other companies simply have no knowledge of these. The lesser-known specific indicators could be good for business, but are currently bad for the comparability across companies. This finding raises the question of the usefulness of the reported indicators, which will be discussed in the following section.

5.2 Usefulness of Reported Indicators

For indicators to be useful and meaningful, various criteria should be fulfilled. The research findings indicate, that - with respect to some of these criteria – the identified indicators are reported at a high quality level. This is due to the fact that with the chosen research design some aspects could be tested, while others would require different methods. Whether or not KPIs are embedded in the strategic management, as suggested by Fung et al. (2007) and Matthews (2011), is not identifiable by the sole means of content analysis. However, criteria of meaningful KPIs such as being clearly defined, easy to use, normative, objective, measurable, comparable and detailed were covered.

Triggered by an identified lack of specific details, Harte and Owen in 1991 claimed that there was room for improvement among perceived good reporters. This study's findings on energy KPI content quality suggest that improvement has taken place. The selected sample of companies in energy intensive industries was expected to consist of good reporters as well, but the results seem to be more positive than the observations made by Harte and Owen more than 20 years ago. The reported KPIs were largely disclosed in a very detailed and accurate manner. The GRI indicators were almost always comparable across companies and – more than half of the time – also comparable over time. Keeble et al. (2003) identified comparability as being a decisive characteristic for internal as well as for external users, providing information necessary for good decision-making. However, some of the very general indicators remained hardly comparable, not due to low acceptance, but due to the diverging nature of disclosure across companies or industries. They did not necessarily always fulfill the KPI criterion of being quantifiable, suggested by Matthews (2011). Some of the disclosures remained purely narrative, which negatively influenced their comparability.

5.2.1 Internal Usefulness

The high quality level of energy KPIs identified in the study suggests that most companies consider the careful collection and detailed reporting to be worth the effort. For which purpose the collected data is actually used internally is hard to tell without insider information. Only a limited number of companies mentioned how the indicator related to their strategic goals. What the published data allows to infer though is, that the higher the quality of the reported indicators, the more possibilities for internal data usage exist. As Waggoner et al. (1999) stated: detailed and objective data could serve the internal purposes of performance monitoring, identification of areas in need for improvement or solely improving internal as well as external communication.

Centindamar and Husoy (2007), as well as other authors, considered the usage of energy indicators to lead to a win-win situation. Not only would it improve the environmental performance of a company, but also the financial performance. The research for this study suggests that several companies share this thought. Not only do they provide data on energy consumption and efficiency over time, allowing for a direct overview over their performance, but they also state explicit goals to save energy and show their progress in the disclosure. Some even make a public statement, reporting about the importance of energy data for the company's financial performance, thereby confirming arguments brought forward by authors such as Allcott and Greenstone (2012), Bloom et al. (2010) or Cowan et al. (2010). Similarly, other companies speak of resource efficiency as being closely linked to cost efficiency. Companies in the 'Chemicals & Synthetics' sector even mention the cost efficiencies that go along with reducing energy. They go beyond simply stating their direct and indirect consumption of energy and publish the related costs as well. Energy KPIs are hence closely linked to financial value for some of the companies in energy-intensive industries.

Given the findings about EMAS registrations and ISO14001 certifications it can be concluded, that environmental management has entered organizational performance management systems. Especially within the 'Utilities' sector environmental management has gained ground. The registered and certified companies have chosen to not only deal with environmental issues, but to actively manage their environmental performance. A statement found in the disclosure of a large utilities company confirms the argumentation of Montabon et al. (2007), namely, that environmental management practices are positively related to good management and firm performance. The company states that environmental reporting is very closely linked to the operational performance of their company and hence of high importance

for the management. Collected environmental indicators are actively used for organizational purposes.

In comparison to other environmental data, energy related data was considered to be easier to collect while providing immediate useful information (Keeble et al., 2003; Brink and Woerd, 2004). Indeed, the findings made with respect to number of disclosures, word count as well as overall quality of reported indicators, suggest, that energy KPIs are easily collectible and readable. As Cowan et al. (2010) discussed, energy conservation and consumption are classified as being straightforward and easy to use, which has been supported by the findings made. For management purposes, this simplifies the process of collection and potentially increases the overall usefulness of energy KPIs, given that limited effort could lead to valuable insights.

5.2.2 External Usefulness

For energy KPI disclosures to be useful and meaningful for external users a first precondition is that the data displayed is informative. Criteria KPIs need to posses to be informative for external users such as the public, creditors and investors, are similar to the ones required for internal usage, as proposed in the literature review by Keeble et al. (2003). The findings concerning the high quality mentioned above are therefore equally relevant for external information users. The high proportion of very detailed, comparative, objective and measurable indicators disclosed suggests that external stakeholders are provided with informative data. Especially identified indicators disclosed at the highest quality level hold information about the progress made and the development of energy management that could be interesting for investors in particular.

Even though only a minority of companies chose the annual report as the main format to place information on energy consumption and efficiency, the fact that this was considered an option suggests that companies are aware of the importance of this information particularly for investors. Especially listed companies were found to disclose energy KPIs in their annual report, while this was less common among privately held or state-owned companies. This is in line with arguments brought forward by Aerts et al. (2008) and Hope (2003) who suggest that this group of external stakeholders is particularly interested in non-financial data.

The authors Dingwerth and Eichinger (2010) argue that environmental reporting is valuable for investors due to the fact that it reduces searching effort and enhances comparability.

Comparability is however only truly achieved if indicators disclosed by different companies are similar in their nature as well as in the way they are published. Comparable indicators identified in the course of this study were some of the frequently used GRI energy indicators as well as a few very general indicators, such as 'Total energy consumption'. Overall, The observed degree of GRI reporters suggests that comparability of energy indicators is high. This holds especially true for 'Chemicals & Synthetics' and 'Utilities' sector data, where the majority of companies chose to report in accordance with the GRI framework.

But apart from the GRI indicators and very general ones, other additional data might be similarly meaningful for external stakeholders. Especially indicators setting energy consumption in relation with sales or products or information on the usage of renewables could provide additional insights into company operations, as argued by Emtairah (2002). The findings show, that these more specific indicators are available, but not commonly spread. Across the two groups of KPIs identified, energy consumption and energy efficiency KPIs, a wide range of indicators covered various topics, but the more specific ones provided only limited comparability. Further, some of these lesser spread indicators were very closely related to a specific industry and not applicable to all industry sectors. Especially within the transport sector, different KPIs were used and little convergence across companies existed. Kolk (2004) mentioned the importance of industry specific measurements for SRI analysts and rating agencies. These more adapted indicators are apparently available, as the study shows, but not yet standardized and known within the respective industry. To increase the value of disclosure on energy KPIs for the SRI industry as well as for other external users the range of meaningful and comparable KPIs could be extended.

Another finding impacting the information value of energy KPIs for external stakeholders was the divergence in energy reporting across countries. The number of companies reporting on energy KPIs was found to be substantially higher in the UK, Germany and Spain than in Italy and Russia. Similarly, the adoption rate of the internationally renowned GRI guidelines in Russian companies lay far behind the rate of companies in the remaining countries investigated. Regarding the reporting quality, country differences were also detected. In line with the rest of the findings, Russian companies reached the lowest overall quality level of reporting. With a larger proportion of Russian companies being privately held or state-owned companies, a possible explanation could be the ownership structure. Companies that are not publicly listed might not feel the need to report non-financial data to the same extent as listed companies. For external information users the differences in reporting quantity and quality

implies, that comparing especially Western European companies with Russian companies will be difficult. The findings suggest that data on energy usage is harder to find in some countries than in others.

5.3 Practical Implications

The findings discussed above have a series of practical implications. Even though, given the sampling method selected, the results are not necessarily applicable to all industries and all companies, they represent a population, which is perceived to be a frontrunner in terms of energy reporting. The findings are therefore close to being best practices and practical implications derived from the findings could potentially shape and improve energy reporting in Europe.

For individual companies, deciding on energy KPIs to use can be a difficult and time-consuming process. But the study has shown, that within the energy-intensive industries differences in quantity and quality of energy disclosures exist. A simple way to practically use this finding is, for companies that are less advanced regarding reporting on energy KPIs, to perform benchmarking. This practice can lead to great insight on which KPIs could be useful for the own company, at what level one can make the disclosure and what is common in the industry and beyond. This holds true also for companies in countries, which have shown to have a weaker reporting culture. Best practices are found across borders, and if no regulatory impulse is given nationally, companies wishing to become leaders in reporting, seeing the positive implications, should look further than just to their national industry peers.

The wide acceptance of GRI energy indicators across the three industries covered in the study suggests, that this voluntary standard gives companies the needed guidance in energy reporting. Their generality is favorable for a comparison across industry, but quality and fit of other non-GRI indicators identified could be a valuable addition. If these more specific indicators were included in an internationally accepted guideline, they could be spread more widely and comparability would thereby increase. Especially the transport sector would benefit from such a measure, given the lower application rate of GRI energy indicators and the larger ratio of industry specific KPIs. Guidelines that are more adapted to an industry could be useful, since very specific energy indicators can be especially meaningful for both management and external stakeholders. A resulting practical implication would therefore be the establishment of standardized, yet sector specific energy indicators.

To improve the overall quality several possibilities exits. Companies could more often include an explanation on how the indicator relates to strategic goals set by the company. This would lead to an improved understanding of the strategic importance the indicator possesses. Further, a more detailed and quantitative disclosure of energy KPIs would increase the informative value and thereby the usefulness for both, internal as well as external information users.

6 Concluding Remarks

This final chapter begins by presenting the conclusions of the study. Further, areas for future research are suggested to gain a deeper understanding of the subject, since the study sheds light on a novel, but broad topic. Finally, the practical contribution to knowledge made by this study is highlighted.

6.1 Conclusion

At current times of rising energy prices and increased public awareness of resource scarcity, reporting on energy KPIs was found to be very common within energy-intensive industries. The companies investigated disclosed a variety of different KPIs on energy consumption and efficiency. The indicators identified ranged from being very general to very specific. Among the published indicators a thematic overlap existed and categories of KPIs with similar content were found.

Most commonly applied across the chosen energy-intensive industries were indicators provided by an internationally accepted guideline, the GRI guideline, as well as very general indicators. The internationally accepted GRI guideline was found to give distinction to reporting on energy-related matters among large European companies. Indicators introduced in the framework of the GRI largely influenced the themes covered in energy reporting. Other common indicators were kept very general and were comparably easy to collect. The fact that these two sets of indicators dominate the field of energy KPIs indicates that the ease of collecting as well as the possibility to compare information considerably influenced the choice of energy KPIs to be reported.

Energy KPIs identified in the course of the study were indeed oftentimes comparable, but this was not always the case. Differences in what companies reported were found across industries. Given that the application of energy varies with respect to the core business of a company, thematic differences played a role. The recently introduced GRI sector supplements could have provided guidance for distinctive and industry-adapted indicators, but the study has shown, that they were not influential in the field of energy KPIs. Meaningful sector-specific indicators were identified in individual companies, but they were not standardized and rarely spread within an industry.

Regarding the quality of reported indicators, the majority of KPIs was found to be disclosed at a high level. The disclosures were largely both, qualitative as well as quantitative, and often

the published data was comparable over time. But across countries qualitative differences could be detected. While Western European companies tended to report more detailed and quantitative indicators than purely narrative ones, especially Russian companies broke ranks. Among the investigated Russian companies a comparably small number of disclosures were identified and the published indicators were on average less detailed and informative, suggesting that a company's home country influences the non-financial reporting culture.

Overall, the identified indicators were largely detailed, comparable, informative and meaningful for both users of energy KPIs, internal as well as external stakeholders. Especially predominant GRI and very general indicators were comparable across industries and countries, but the findings suggest room for improvement. Benchmarking could be a solution as well as the development of a set of standardized, yet industry specific energy KPIs.

6.2 Future Research

Given the very focused research conducted in the study, the wide area of energy KPIs offers various opportunities for future research on this topic. Energy scarcity is likely to regain more attention as soon as the current economic crisis is endured.

This study investigated energy KPIs used by large European companies. One way to expand the research would be to include or concentrate on small to medium sized companies, a population, where different rules might be applicable, but which is similarly confronted with rising energy prices and energy savings opportunities. Further, innovative concepts or guidelines from other continents could be a valuable contribution to the research on energy KPIs, which is why a study with a more international scope could provide interesting insights. Due to time and resource constraints this study investigated companies in five European countries. The detected differences concerning reported energy KPIs suggest that the inclusion of further countries would be valuable.

In the course of this study the link between energy KPIs and company strategy was identified as an important aspect for good and meaningful energy reporting. The nature of this study focused on characteristics of good KPIs, which were detectable by the means of content analysis. An insightful approach for future studies would be to determine the meaning of KPIs with respect to their link to corporate strategy. Other formats of research such as interviews with company representatives would give additional insight on the use of energy KPIs for management.

Finally, the GRI as an internationally accepted standard was found to shape energy reporting to a large extent. The related GRI sector supplements however were not significant in this field. A closer investigation of GRI sector supplements with a focus on energy related KPIs could shed light on this issue.

6.3 Contribution to Knowledge

During the literature review a gap was identified in the research area on energy KPIs used in practice. The majority of existing studies cover environmental reporting as a whole. This study provides a more focused picture on energy KPIs, a group of KPIs with a very close link to a firm's financial performance.

Instead of investigating the motivations for environmental reporting this study adds to the existing knowledge by focusing on the reported content. It gives an overview of the current state of data collection and reporting on energy KPIs across large European companies and determines what is actually reported and at which quality level.

Further, the method applied went beyond being purely mechanistic. Due to the combination of mechanistic and interpretive elements, the qualitative assessment of energy KPIs was possible and contributes to the field of environmental reporting and energy management by providing an overview of best practices.

Finally, the study strengthens existing theories concerning the importance of internationally accepted guidelines to improve non-financial reporting and identifies improvement potential in the area of sector specific guidelines. It provides guidance for the choice and composition of energy KPIs as well as for their assessment.

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Appendix

Appendix 1: Company Overview by Alphabetical Order

Name	*Industry*	*Country*	*Document's Type/Name*	*Year*
A MENARINI INDUSTRIE FARMACEUTICHE	Chemicals & Synthetics	Italy	No Information	2011
A2A SPA	Chemicals & Synthetics	Italy	Online	2011
AIR FRANCE KLM	Transport	France	Seperate Report	2011
ALITALIA	Transport	Italy	Online	2011
ARKEMA	Chemicals & Synthetics	France	Seperate Report	2011
ASTRAZENECA PLC	Chemicals & Synthetics	UK	Online	2011
BASF SE	Chemicals & Synthetics	Germany	Annual Report	2011
BAYER AG	Chemicals & Synthetics	Germany	Online	2011
BERLINER VERKEHRSBETRIEBE (BVG)	Transport	Germany	Seperate Report	2011
BP AROMATICS LIMITED	Chemicals & Synthetics	UK	Online	2011
BRACCO SPA	Chemicals & Synthetics	Italy	Online	2011
BRITISH AIRWAYS PLC	Transport	UK	Seperate Report	2011
BT GROUP PLC	Utilities	UK	Online	2011
C.H.BOEHRINGER SOHN AG & CO. KG	Chemicals & Synthetics	Germany	Online	2011
CENTRICA PLC	Utilities	UK	Online	2011
CHIESI FARMACEUTICI SPA		Italy	Online	2011
CMA CGM	Transport	France	Online	2011
DACHSER GMBH & CO. KG	Transport	Germany	Online	2011
DB REGIO AKTIENGESELLSCHAFT	Transport	Germany	Seperate Report	2011
DEUTSCHE LUFTHANSA AG	Transport	Germany	Seperate Report	2011
DEUTSCHE TELEKOM AG	Utilities	Germany	Online	2011
E-ON SE	Utilities	Germany	Online	2011
EASYJET AIRLINE COMPANY LIMITED	Transport	UK	Online	2011
EDF	Utilities	France	Seperate Report	2011
EDISON SPA	Utilities	Italy	Seperate Report	2011
ENBW AG	Utilities	Germany	Seperate Report	2011
ENEL SPA	Utilities	Italy	Seperate Report	2011
FINANCIERE DE L'ODET SA/BOLLORÉ	Transport	France	No Information	2011
FIRSTGROUP PLC	Transport	UK	Online	2011
FRANCE TELECOM SA	Utilities	France	Seperate Report	2011
FRATELLI COSULICH SOCIETA PER AZIONI		Italy	No Information	2011
GDF SUEZ	Utilities	France	Seperate Report	2011
GESTORE DIE SERVIZI ENERGETICI GSE SPA	Utilities	Italy	Seperate Report	2011
GLAXOSMITHKLINE PLC	Chemicals & Synthetics	UK	Seperate Report	2011
GRIMALDI COMPAGNIA DI NAVIGAZIONE SPA	Transport	Italy	No Information	2011
HAPAG-LLOYD EXPRESS GMBH	Transport	Germany	Online	2011
HENKEL AG & CO KGAA	Chemicals & Synthetics	Germany	Online	2011
JOHN SWIRE & SONS LIMITED	Transport	UK	Seperate Report	2011
JOHNSON MATTHEY PLC	Chemicals & Synthetics	UK	Seperate Report	2011
JOINT STOCK COMPANY 'AEROFLOT-RUSSIAN AIRLINES	Transport	Russian Federation	Annual Report	2011
JOINT STOCK COMPANY ACRON	Transport	Russian Federation	Online	2011
JOINT STOCK COMPANY FREIGHT ONE	Utilities	Russian Federation	Online	2011
JOINT STOCK COMPANY URALKALI	Chemicals & Synthetics	Russian Federation	Seperate Report	2011

L'AIR LIQUIDE	Chemicals & Synthetics	France	Seperate Report	2011
L'OREAL SA	Chemicals & Synthetics	France	Seperate Report	2011
LINDE AG	Chemicals & Synthetics	Germany	Seperate Report	2011
MAPEI SPA	Chemicals & Synthetics	Italy	Annual Report	2011
MOBILE TELESYSTEMS OJSC	Utilities	Russian Federation	Online	2011
NATIONAL GRID PLC	Utilities	UK	Online	2011
NETWORK RAIL LIMITED	Transport	UK	Online	2011
NIZHNEKAMSKNEFTEKHIM INCORPORATED	Chemicals & Synthetics	Russian Federation	Annual Report	2011
OAO AK TRANSNEFT	Transport	Russian Federation	Online	2011
OJSC LONG-DISTANCE AND INTERNATIONAL TELECOMMUNICATIONS 'ROSTELECOM	Utilities	Russian Federation	Seperate Report	2011
OPEN JOINT STOCK COMPANY GAZPROM	Transport	Russian Federation	Seperate Report	2011
OPEN JOINT STOCK COMPANY MEGAFON	Chemicals & Synthetics	Russian Federation	Seperate Report	2011
OPEN JOINT STOCK COMPANY RUSSIAN RAILWAYS	Transport	Russian Federation	Online	2011
OPEN JOINT STOCK COMPANY VIMPEL-COMMUNICATIONS	Utilities	Russian Federation	Seperate Report	2011
PROTEK OAO	Chemicals & Synthetics	Russian Federation	No Information	2011
RECKITT BENCKISER GROUP PLC	Chemicals & Synthetics	UK	Seperate Report	2011
REGIE AUTONOME DES TRANSPORTS PARISIENS	Transport	France	Seperate Report	2011
RWE AG	Utilities	Germany	Online	2011
SANOFI	Chemicals & Synthetics	France	Online	2011
SNAM SPA	Transport	Italy	Online	2011
SOCIETE NATIONALE DES CHEMINS DE FER FRANCAIS	Transport	France	Seperate Report	2011
SSE PLC	Utilities	UK	Annual Report	2011
TELECOM ITALIA SPA	Utilities	Italy	Seperate Report	2011
TELECOMMUNICATION INVESTMENT JOINT STOCK COMPANY - SVYAZINVEST	Utilities	Russian Federation	No Information	2011
TOTAL PETROCHEMICALS FRANCE	Chemicals & Synthetics	France	Online	2011
TRENITALIA SPA	Transport	Italy	Seperate Report	2011
VEOLIA ENVIRONNEMENT	Utilities	France	Seperate Report	2011
VERBUNDNETZ GAS AG	Utilities	Germany	No Information	2011
VERSALIS SPA/ENI SPA	Chemicals & Synthetics	Italy	Annual Report	2011
VIVENDI	Utilities	France	Seperate Report	2011
VODAFONE GROUP PUBLIC LIMITED COMPANY	Utilities	UK	Online	2011
ZAO SIA INTERNATIONAL LTD	Chemicals & Synthetics	Russian Federation	No Information	2011

Source: Own Illustration

Appendix 2: Coding by Theme

Field	*Category*	*Key Performance Indicator*
Energy consumption		
	Total energy usage	Energy consumption
		Net purchases of energy
	Direct Energy consumption	EN3 Direct energy consumption by primary source
		Use of fossil primary source of energy
		Use of biogenic energy source
		Fuel consumption
		Annual thermal energy consumption
	Indirect energy consumption	Electricity consumption
		EN4 Indirect energy consumption by primary source
	Renewables	Usage of renewables
		Contribution of renewables to electricity generation
	Consumption relative to output	Energy consumption relative to sales volume
		Monetary Power Efficiency Index (MPEI) in which developments in energy consumption is indicated in relation to revenues
		Energy usage per 1000 products
		Energy usage per unit of production
		Evolution of energy consumption per m^3 of air gas produced
		Fuel/Energy consumption (per passenger/per freight)
	Energy Savings	Energy savings
		Annual electricity savings
		EN7 Initiatives to reduce indirect energy consumption and reductions achieved
	Energy used for transportation	Absolute primary energy consumption of journeys
		Evolution of distance traveled per ton of gas delivered
		Average energy for train operation
		Distance traveled
		Upstream consumption/loss
Energy efficiency		
	Efficiency	Energy efficiency
	Production efficiency	Energy efficiency in production processes
		Eco-efficiency indicator (service/joule)
	Energy Savings	EN5 Energy saved due to conservation and efficiency improvements
		Refining energy efficiency index
		Petrochemicals energy efficiency
	Energy efficiency initiatives	EN6 Initiatives to provide energy-efficient or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives
		Energy efficiency certificates distributed
		Photovoltaic installed
		Electronic meters installed
		Non hazardous waste incineration plants equipped with energy conversion systems
	Transport efficiency	Fuel efficiency

Source: Own Illustration

Appendix 3: Coding Scheme for Quality

Disclosure Type	*Definition*	*Example*
1	Disclosure addresses issue related to indicator; purely narrative	"With us environmental protection is more than merely the fulfilment of legal requirements." (KarstadtQuelle, 2000:51) "Reckitt Benckiser is committed to running its business in a responsible, environmentally sound and sustainable manner." (Benckiser, 2000:23) "We will work more closely with customers and suppliers to improve the recyclability of products and the efficiency of processes." (GKN, 2002:27).
2	Disclosure addresses issue related to indicator and provides detail; purely narrative	"Lufthansa is particularly committed to protecting the crane, which is the airline's emblem and an endangered species. Together with German Society for Nature Conservation (NABU) and the World Wildlife Fund Germany Lufthansa supports the national crane protection group "Kranichschutz Deutschland" which maintains a well-attended crane information and visitor centre in Grob Mohrdorf in the eastern German state of Mecklenburg-Western Pomerania." (Lufthansa, 2002:48)
3	Disclosure addresses issue related to indicator in numerical way; purely quantitative	"Worldwide expenditure on environmental protection and safety in the year under review totalled roughly V 42 million." (Beiersdorf, 2002: 51) "We invested £45 million in upgrading environmental standards and deploying new systems and technology." (BT, 2004:13) "The double-skin facade means that around 20% less heating energy is needed compared with regular HVAC technology, and the use of cool ground water will reduce energy requirements in summer by around 30%." (Deutsche Post, 2002: 43)
4	Disclosure addresses issue related indicator in numerical way, including qualitative explanations; narrative and quantitative	"The 240 acre Community Parkland we created at our Waterside offices, out of a former refuse tip, will be fully opened this summer. We have planted 60,000 new trees, cleaned out the 3 rivers running through it and have created 12 km of pathways. Education rangers are giving lessons on environmental and conservation issues using the Parkland." (British Airways, 2000:15) "During the 2001 financial year, we reduced the amount of copier paper we purchased by 290 tonnes, largely due to increased use of e-mail and the BT intranet." (BT, 2001:27) "Of the provisions for reclamation, 150 million in 2002 (2001: 151 million) is for potential damages arising from former hard coal mining activities and 176 million (2001: 99 million) for those from lignite mining." (E.ON, 2002: 137)
5	Any numerical disclosure to the indicator including qualitative statements demonstrating year comparisons; narrative, quantitative and comparable	"In 2003, our operating and maintenance costs in the field of environmental protection and safety totalled V76 m (2002: V74 m)." (Schering, 2004:50) "Significant environmental incidents arising directly from the Group's activities increased from 32 (2002/03) to 46 (2003/04), principally as a result of better monitoring in our UK Gas Distribution operations." (National Grid Transco, 2004:16)

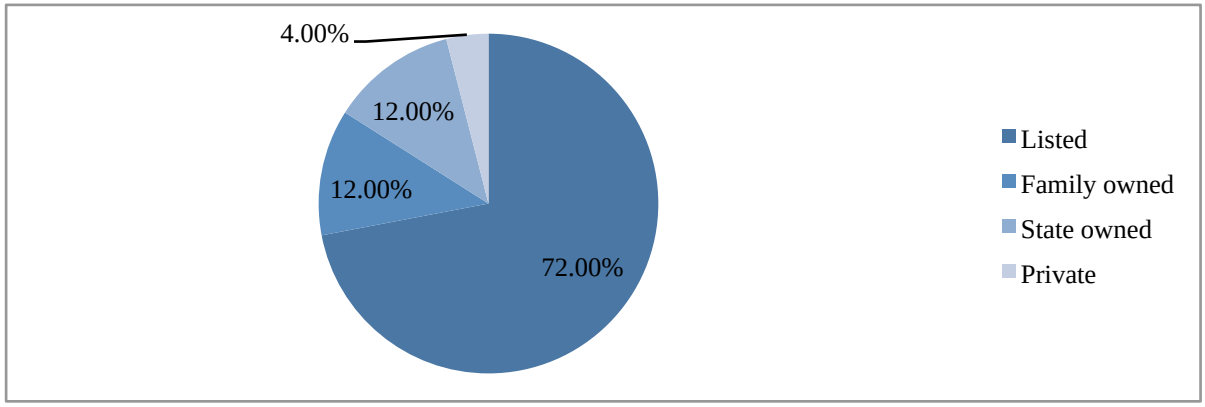
Source: Beck et al. (2010)

Appendix 4: GRI Indicators for the Aspect Energy

Application	*Acronym*	*Description*
Core	**EN3**	Direct energy consumption by primary energy source.
Core	**EN4**	Indirect energy consumption by primary source.
Additional	**EN5**	Energy saved due to conservation and efficiency improvements.
Additional	**EN6**	Initiatives to provide energy-efficient or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives.
Additional	**EN7**	Initiatives to reduce indirect energy consumption and reductions achieved.

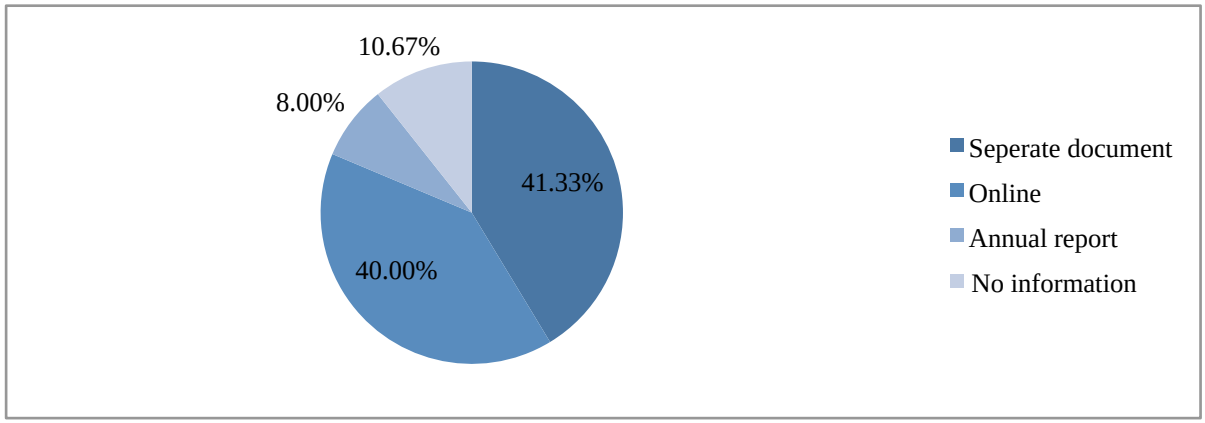
Source: GRI. (2013)

Appendix 5: Ownership Structure of Sampled Companies



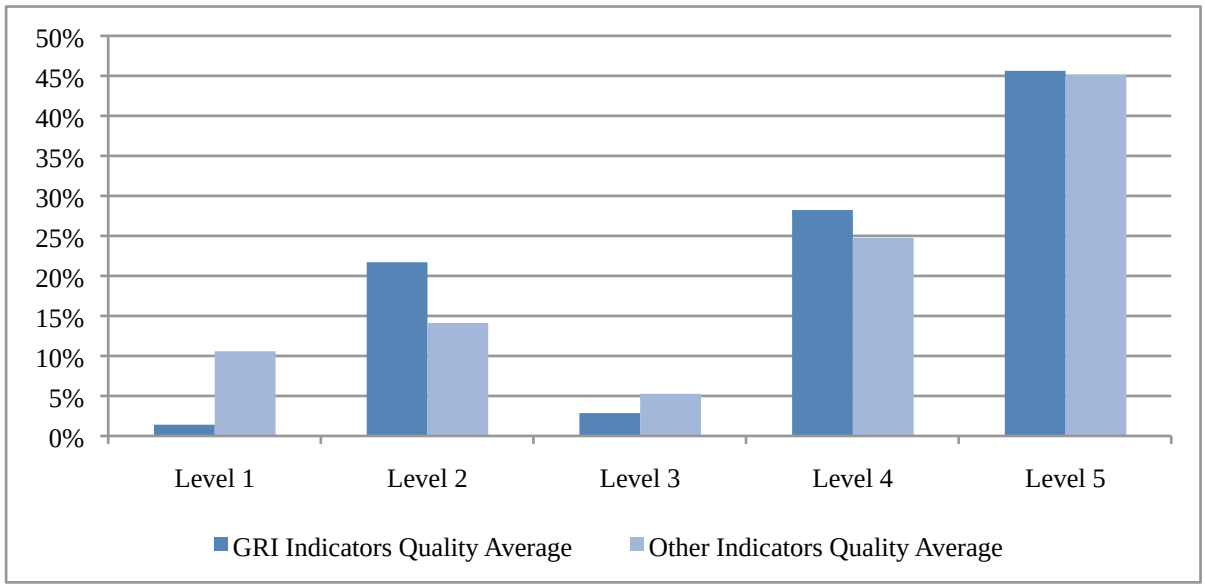
Source: Own Illustration

Appendix 6: Major Format of Reporting on Energy KPIs



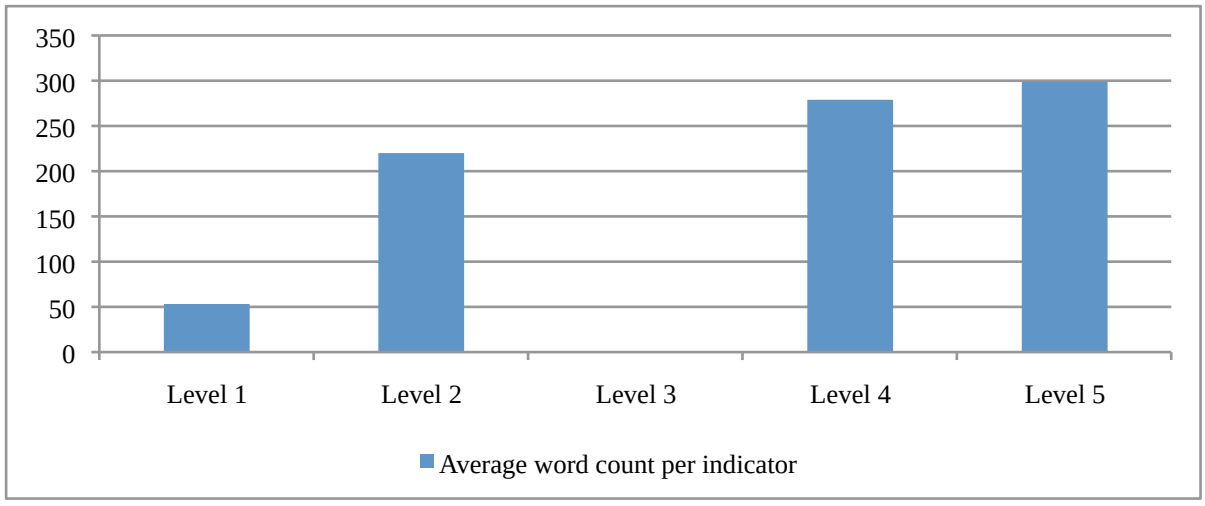
Source: Own Illustration

Appendix 7: Difference in average quality between GRI and non-GRI indicators



Source: Own Illustration

Appendix 8: Average word count per indicator whole sample



Source: Own Illustration